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FOR THE YEAR

1926

Journal of the
Royal Microscopical Society

CONTAINING ITS TRANSACTIONS AND PROCEEDINGS

AND

A SUMMARY OF CURRENT RESEARCHES RELATING TO

ZOOLOGY AND BOTANY

(principally Invertebrata and Cryptogamia)

MICROSCOPY, &c.

EDITED BY

JOHN W. H. EYRE, M.D. F.R.S.Edin.,

Professor of Bacteriology in the University of London

WITH THE ASSISTANCE OF

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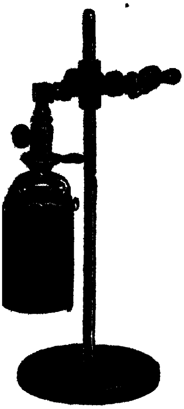

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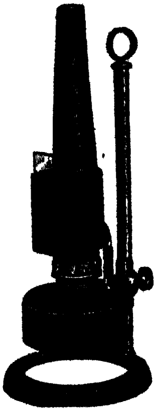

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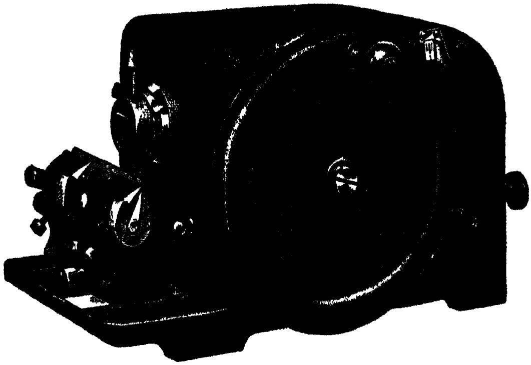

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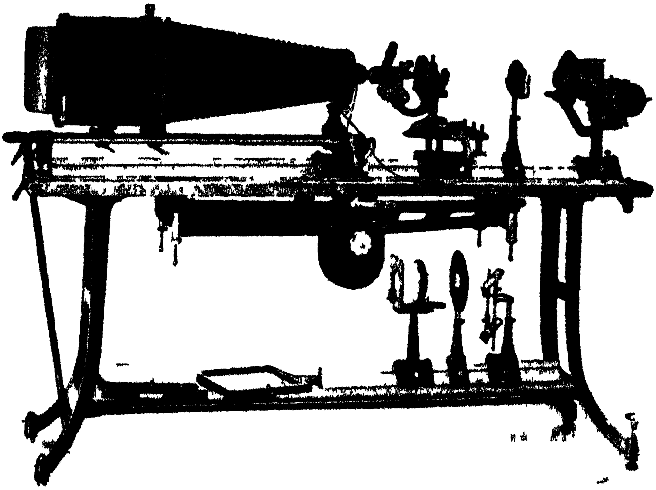

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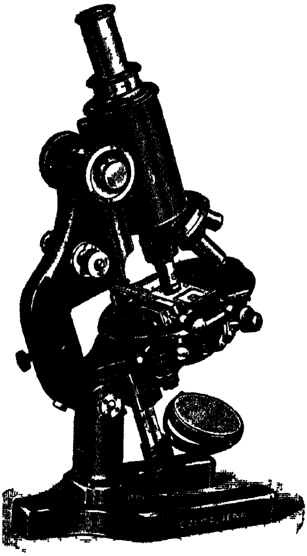

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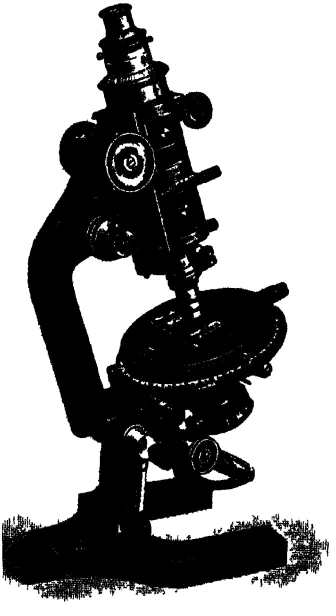

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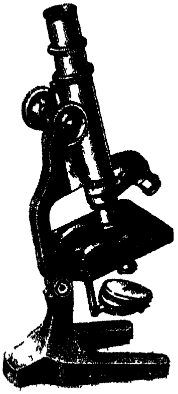

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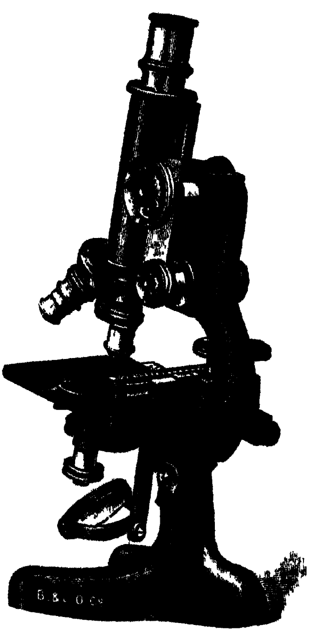

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MARCH, 1926.

TRANSACTIONS OF THE SOCIETY.

I.—THE PRESIDENT'S ADDRESS: THE FUNGI IMPERFECTI, AND A FURTHER PLEA FOR AN INSTITUTE OF INDUSTRIAL MICRO-BIOLOGY.

By A. Chaston Chapman, F.R.S., F.I.C., F.R.M.S.

(*Read January* 20, 1926.)

The scientific classification of a group of organisms so large and containing so many intermediate or "transitional" members as that of the Fungi is obviously attended with very serious difficulties, and numerous attempts in this direction have been made from time to time. In most of the schemes which have been put forward it is customary to divide the *mycomycetes*, which are characterized by the formation of *septate mycelium*, into two main groups, the *ascomycetes*, which includes the yeasts with which I dealt in my address last year, and a group known usually as the *Fungi Imperfecti*. This latter group includes a number of organisms which differ very considerably from one another, and which are so classed together chiefly because our knowledge is not at present sufficient to permit of more definite positions being assigned to them. Among the better known of this group are *torula*, *mycoderma*, *monilia*, *chalara*, *endomyces* and *oidium*.

Although the systematic mycologist may not regard this classification as altogether beyond criticism, it has an advantage from my own point of view this evening. You may remember that in my address last year I dealt with another large and much better defined group of the lower fungi, namely, the *Saccharomycetes* or Yeasts. On that occasion I called attention to the fact that whilst a number of the yeasts are definitely cultivated for indus-

B

trial purposes, others occur wild in nature, and are known to be industrially pathogenetic. In the case of the *Fungi Imperfecti* to which I propose to refer this evening, the majority are intrusive organisms of an undesirable character from the manufacturer's point of view, but in not a few cases are they known to be productive of useful and beneficial results.

Perhaps the most important, and in some respects the most interesting, organisms included among the *Fungi Imperfecti* are the torulæ. The word *torula*, at one time regarded as more or less synonymous with *saccharomyces*, and used to designate the ordinary yeasts, has, since the classical investigations of Hansen, been restricted to those unicellular, budding fungi which, unlike the true yeasts, are apparently incapable of forming ascospores. That they are in some way related genetically to the Saccharomycetes can scarcely be doubted; but the nature of the relationship is very obscure, and it would carry me beyond the limits of this address to deal with any of the views which have been put forward. In the case of a group of organisms in which morphological and physiological differences are often so slight, there are many possibilities of error, and there can be very little doubt but that in many cases one and the same organism has been described as new by different workers, and has passed into the literature of the subject under different names. As I have indicated above, the torulæ are unicellular, non-sporing, budding fungi. As a rule they are spherical, but occasionally they are ellipsoidal and elongated, and almost invariably smaller than the cultivated yeasts. They occur very widely spread in nature, and many of them are of some industrial significance. Colourless as a general rule, some produce a red pigment, which I have shown to be closely related to carrotene, whilst one or two are black. In a few species, sometimes referred to as the *mycotorulæ*, there is a tendency to the formation of mycelium, or rather to the production of greatly elongated cells. They are of frequent occurrence in breweries, dairies, sugar factories, oil refineries, and other food factories, and are met with in the air, in the soil, in the secretion of trees, and in the intestinal tract of animals.

As compared with the Saccharomycetes their fermentative activities are feeble, but like the yeasts, they differ considerably in respect of the enzymes they secrete, and consequently of the sugars they are able to ferment. In some cases only dextrose and fructose are fermented, whilst other species are able to ferment a considerable variety of carbohydrates, including cane sugar, maltose, mannose, lactose, galactose, and even raffinose and arabinose.

In breweries these organisms are not often a source of serious trouble, since owing to their lower fermentative activities they are easily kept in check by the more vigorously fermenting yeasts. One or two species, however, have been credited with the production of unpleasant flavours and turbidity, whilst others may apparently give rise to "ropiness" or "slime" in liquids of low alcoholic strength. On the other hand, it has been shown that some of these torulæ serve a useful purpose, and in 1905 Claussen described a small group of organisms to which he assigned the name *Torula Brettanomyces*, and which are frequently associated with the conditioning of English bottled beers. A few years later these organisms were more closely investigated by Schiönning, who showed that they could be referred to two distinct groups, both of which are capable of bringing about a slow and lasting fermentation in beer, and in the case of beer in bottle of giving a considerable amount of gas, a stable head and a characteristic flavour and aroma, due to the reaction of the acid formed as a result of their activity, with the alcohol present in the beer.

In the cider industry, again, torulæ appear to play a not unimportant part, and especially in connection with the conditioning of bottled cider, since out of thirteen yeast-like organisms isolated from bottled ciders by Pearce and Barker, no less than five torulæ were found in apparently active condition.

Important as is frequently the part played by torulæ in the fermentation industries, their significance in the dairying industry is even greater. Here, however, they usually figure in a pathogenetic capacity. Having regard to their almost universal occurrence in the air, especially at certain times of the year, it is not at all surprising that milk should be so frequently infected with different species or varieties of torulæ. As a consequence of their development, some of these produce acidity followed by curdling; others produce a bitterness or other unpleasant flavours; whilst others again are responsible for the production of colouring matters. In this connection, and as bearing upon the value of Pasteurization, it may be of interest to note that the thermal death-point of these organisms is usually in the neighbourhood of 60° C.

Having regard to the well-established fact that some of the torulæ are known to be pathogenic to man and other animals, their presence in milk may have a more serious significance than is usually assigned to it. There is, in fact, some evidence to show that gastric disturbances have at times been caused by torulæ present in milk, and a considerable number of species have been described which are more or less virulently pathogenic to the lower animals, and some of them probably to man.

In the case of condensed milk, again, the presence of these organisms is frequently a source of considerable trouble to the manufacturer, since they are capable of developing, though slowly, even in very strong sugar solutions, with the production of carbon dioxide gas, alcohol, acidity and other products. Thus, some species will develop apparently without difficulty in sweetened condensed milk containing as much as 43 p.c. of cane sugar in addition to 18 p.c. of milk sugar, and only 24 p.c. of water. This results in the blowing of tins, and is at times a source of very considerable loss to the makers of condensed milk. In the course of my own experience, extending over a good many years, I have only found the production of gas in condensed milk to be due to any other than torulaceous organisms in a very small percentage of cases. On the other hand, some species of torulæ have a limited sphere of usefulness in the production—in symbiotic connection with certain bacteria—of fermented milk beverages largely consumed in the East, such as Kephir, Koumiss, Mazun and others.

From cheese a certain number of torulaceous organisms have at various times been isolated, but whether they serve any useful function, or are to be regarded as inert or injurious does not appear to be known with certainty. On the surface of hard cheese torulæ are occasionally met with, liquefying the casein, giving rise to the production of gas, and causing, in consequence, a blistered appearance. I have also met with them on the surface of bacon, and in many other foodstuffs.

In butter torulæ are also sometimes present, as well as in some badly refined vegetable oils, and as they occasionally contain a lipolytic enzyme and produce fatty and other acids, they are very apt to give rise to pronounced rancidity.

In raw sugars torulæ are frequently abundant, their activity being of an essentially destructive character.

Among the more interesting members of this group of organisms must be mentioned those species or varieties which can grow in strong salt solutions. Several of these have been isolated, and are found to be capable of developing in nutrient media containing as much as 30 p.c. or even 35 p.c. of common salt. These have been found at times to occur in pickled fish, and are said to have produced trimethylamine and other unpleasantly smelling compounds. Torulæ have even been isolated from sea-water.

Many other interesting facts in connection with these organisms, and a considerably larger number of references to foodstuffs and other commercial products in which their presence in an active condition have been observed, might have been given. I think, however, that I have said enough to show how very important these organisms may be from the industrial point of view. In the majority of cases they are, as I have indicated, industrially pathogenetic organisms, which it should be the object of every food manufacturer to exclude. In a few instances, however, they appear to serve useful functions, and it seems probable that with a greater amount of systematic research it will be found that they can be more largely utilized in connection with a number of industries in somewhat the same manner as the culture yeasts of commerce have been employed in the industries concerned with fermentation.

A second important group of the *Fungi Imperfecti* includes the various species of *mycoderma.* This consists of organisms which develop in contact with air, and which are frequently found in the form of a greyish, wrinkled, and often greasy film on the surfaces of beer, wine or other alcoholic liquids which have been exposed for some time to the air Morphologically they consist of rounded or elongated cells, the shape of which varies very greatly, even in one and the same species. When young they are found to be more or less rounded, whilst in older films they become much more elongated, their diameter diminishes, and they present a shrivelled appearance. The younger and more vigorous cells are characterized by the presence of a number of highly refractive granules and fat globules. They reproduce by budding and do not form spores. By some authors these organisms have been described as non-sporing forms of the *pichia* and *willia* groups of the Saccharomycetes, the members of which also form films. For this view there is not, so far as I am aware, any direct evidence, and these organisms must, I think, in the present state of our knowledge, be looked upon as a distinct group somewhat widely separated from the Saccharomycetes. Unlike the latter they do not, as a rule, produce any alcohol, but on the contrary thrive on the surface of alcoholic liquids, oxidizing the alcohol away to carbon dioxide and water, or occasionally using a portion of it as food material. One or two species, it is true, seem to be feebly active in the direction of producing alcohol, but this is quite unusual. Some mycologists claim to have isolated a large number of distinct species, but having regard to the very variable nature of the mycoderma, both morphologically and physiologically, there can, I think, be very little doubt that some at least of these so-called species are merely varieties.

The mycoderma are very widely distributed in the air, and as their action is almost invariably pathogenic from the industrial point of view, they are of considerable significance to a large body of manufacturers. Thus, in the case of bottled beer, in which the bottles have not been properly filled, and in which a little air remains in the neck, this organism may be found as a film on the surface of the beer, which is in consequence rendered unsaleable.

In the case of wine, its effects are at times equally disastrous, the organism destroying the bouquet and frequently producing unpleasant substances, among which butyric acid has been observed. It should be pointed out that in the case of wine, at least, the ill effects of this organism have been noticed even in cases where there has been no obvious film, the results having been produced by cells in suspension. In such cases, however, the action is very much slower than when the cells are developing freely on the surface.

From *mycoderma* we may pass to the brief consideration of a further group of organisms frequently included in the *Fungi Imperfecti.* This inclusion is due not to any particular resemblance or connection between the members of this group, but to the fact that there is still a great deal of uncertainty attaching to their true genetic relationship to other organisms to which more or less well-defined positions have been assigned in the classification of the lower fungi. I propose to refer here only to *monilia, chalara, endomyces* and *ooidium,* four organisms which bear some resemblance to the Saccharomycetes on the one hand, and to certain of the moulds on the other, and which are therefore occasionally referred to as mould-yeasts. Thus, these organisms produce, on the one hand, cells not differing greatly in appearance from the Saccharomycetes, and like them often capable of producing alcohol, whilst, on the other, they resemble the moulds in giving rise to the production of well-marked mycelium.

In the case of *monilia,* both elongated, mycelium-like cells are formed as well as small more or less rounded cells, resembling yeast which are capable of bringing about a vigorous alcoholic fermentation in liquids containing sugar. This organism occurs rather widely in fermented beverages, and is sometimes met with in bread, cereal foods and on the surface of ripe fruits. One species at least is possessed of marked pathogenic properties.

Chalara, like *monilia,* readily forms a film on the surface of nutrient liquids, and consists of branched mycelium and more or less rounded cells having a characteristic appearance under the microscope. This organism is met with in wine, milk, fruit juices, and many other foods—solid and liquid.

In the *ooidia* we have a class of organisms inclining more decidedly to the moulds, and often classified with the *Basidiomycetes,* but connected by many transitional forms with other members of the *Fungi Imperfecti,* and therefore conveniently included in that heterogeneous grouping. The chief representative is the ordinary *ooidium lactis,* an organism which occurs very widely distributed in nature, and which is so frequently seen on the surface of sour milk, cheese, butter, pressed yeast, and many other products. Resembling *monilia* in some respects, it differs physiologically from that organism in possessing much feebler fermentative activity. It destroys the lactic acid in sour milk and in cheese, just as the *mycoderma* is responsible for its destruction in pickles and in other acid liquids. Thus, milk in which *ooidium* is growing may finally become neutral, or even slightly alkaline, owing to the decomposition of the protein constituents. In the case of certain cheeses, notably Camembert, this mould plays a not unimportant part in the so-called ripening process. One species at least, *ooidium albicans,* is pathogenic.

The genus *endomyces* resembles *ooidium* in some respects, especially in its morphological characters. The cells which form in the mycelium when free develop by budding or by division, but in many species asci are formed, containing from two to four spores. Several of these species have their habitat in the gummy or milky discharges from trees, such as the oak, the maple, and the birch.

It was the well-known interest taken by Professor Lindner, of the Institut für Garungs-Gewerbe, Berlin, in the investigation of the flora of these exuded tree-saps which gave, a few years ago, a new direction to the study of certain of the lower fungi. It had been for years a matter of common knowledge that ordinary yeast (*Saccharomyces cerevisiæ*) could be utilized for food purposes, either (chiefly for animals) when merely dried, or, after having been submitted to a certain treatment, in the form of an extract closely resembling extract of meat in its appearance, flavour, and chemical composition. Apart from this, however, no attempt had been made to produce any of the microscopic fungi expressly for human food, and technical mycologists had restricted their attention to a study of the changes which these organisms were capable of bringing about in certain media, and of the products (alcohol, lactic acid, butyric acid, flavouring substances, etc.) of their activity. In 1916 Lindner received from one of his pupils, who was serving in the War on the Eastern Front, a small specimen of the exuded sap from the stump of a birch tree. On examining this microscopically it was found to contain only cells which resembled yeast-cells in appearance, and on submitting these to further investigation, and after pure cultures had been prepared, it was found that the predominant organism had the property of forming large proportions of fat, and of thriving in solutions containing the whole of the nitrogen in the form of ammonium salts. The organism grew freely on the surface of carbohydrate solutions, forming a thick greasy film which, when separated and dried, contained 18 p.c. of fat, 31 p.c. of crude protein, and 43 p.c. of carbohydrates. Given a cheap and abundant source of carbohydrate, and the necessary supply of nitrogen in the form of ammonium salts obtained from the air, it was evident that a food product rich in fat and protein could be produced in large quantity. We have it on the authority of Prof. Hayduck that at the outbreak of the War the German yeast-drying factories were fully mobilized and produced some 20,000 tons of dried yeast annually, which was used for feeding purposes. It became, however, necessary to find some other material similar to yeast, but not dependent upon the production of beer which had by order of the Government been reduced to 60 p.c. of its pre-war production. It was here that Lindner's organism seemed to supply the want, and after a little time, spent in experimenting on the best conditions for its growth, the so-called "mineral yeast" was produced in considerable quantities in Germany, and was used to supplement the bread ration. In 1917 I was fortunate in obtaining a mixed growth, from which I was able to isolate an organism very similar to, if not identical with, the German "mineral yeast" The organism in question was not a true yeast—that is, it did not belong to the genus *Saccharomyces*, and did not produce alcohol; it would have, I think, to be included in the heterogeneous group of the *Fungi Imperfecti.* It formed a thick, greasy, crinkled film when growing on the surface of the nutrient solutions, and developed best at a temperature of 38–40° C. A full crop needed about thirty-six to forty-eight hours for its development, and the separated organism when dried contained about 50 p.c. of crude protein, and up to about 10 p c. of fat. It was entirely free from the bitterness which characterizes yeast, and when pressed formed cakes having the odour and flavour of cream cheese. Glucose or molasses served for the carbohydrate portion of the nutrient medium, and only ammonium salts were needed to supply the nitrogen. Inasmuch as ammonium salts can be readily obtained from the air, and since the carbohydrates resulting from the acid hydrolysis of wood could be used as a source of carbon, it is obvious that this organism rendered it possible in the short space of thirty-six hours to build up fat and protein from such comparatively cheap raw materials as ammonium phosphate and the glucose resulting from the conversion of sawdust or other cellulosic materials. In times of peace this process possesses little more than scientific interest, but it is a good example of the manner in which the lower fungi can be utilized, and of the way in which the activities of the living cell can be harnessed in the service of man.

That an efficient biochemical process for the conversion of cellulose into sugar will ultimately be discovered there can be little doubt, and with such a process the production of a synthetic food-product on a large scale would become a matter of practical politics, even perhaps under peace conditions. I cannot refrain from giving, not for the first time, a quotation from a lecture which Hayduck delivered in Berlin in 1916. He said: "When we can convert our evening papers into sugar so rapidly that we are able the following morning to eat for breakfast the albumen prepared therefrom, then indeed shall we have solved one of the greatest problems of the century." This strikes a high note of optimism, and is characterized by an enthusiasm truly Teutonic; but who, in these days, shall say that before very long both the optimism and the enthusiasm may not prove to have been entirely justified? This brings me to a matter with which I have dealt on a number of occasions, and to which I should like to refer once more this evening—I mean the extended and concentrated study of industrial micro-biology. In an address given to the Society of Chemical Industry in 1919 I drew attention to the want in this country of proper provision for systematic research and instruction in this subject, and put forward a plea for the foundation of a National Institute which should be devoted to that, among other ends. Scarcely anyone believes to-day that the chemical processes involved in the synthesis of organic substances by plants or animals differ in any essential respect from those with which we are familiar in our laboratories, or that there is some peculiar "vital force" the nature of which is beyond our ken. The long list of naturally occurring chemical substances which have been produced by ordinary laboratory methods, and especially perhaps the recent striking work of Baly and others on the artificial photosynthesis of carbohydrates, have gone far to dispose of such a view. Still, great as have been the advances in our knowledge during comparatively recent years, the time is certainly very far distant when we shall be able to dispense with the services of the living cell. Before that day dawns we shall need to know very much more of the manner in which the cell performs its remarkable feats of building up and breaking down, and of the precise nature of the colloidal processes and enzymic forces at work in this wonderful little laboratory. For the present, and doubtless for some considerable time to come, it is the fact that a number of important industries are dependent on the activities of certain lowly organisms, and so far from diminishing I believe the number will increase with further study and greater knowledge. My object in selecting the *Fungi Imperfecti* as the introductory subject of my address to-night was not so much to draw attention to an interesting, if heterogeneous, group of organisms, as to show that outside the ranks of the yeasts, the bacteria, and the better known moulds, there are microscopic fungi of an ill-defined character, many of which have received very inadequate study of a systematic kind.

With extended research who can say that other organisms of this character having important industrial possibilities may not be discovered, and have to find their home—for a time at least—among the *Fungi Imperfecti*? It is, in fact, the special charm of this branch of study that the micro-biologist never knows at what moment his labours may be rewarded by the discovery of an organism possessing quite unsuspected properties, and perhaps capable of some remarkable achievement in the domain of chemical synthesis. To enumerate all the industries in which micro-organisms play an important part would be impossible within the limits of a Presidential Address, even if it were at all necessary. Suffice it to say that there are few industries concerned with the manufacture of animal or vegetable products in which enzyme action of the kind manifested in such perfection in the life activities of these lowly organisms does not figure as one of the most important factors. For more than a quarter of a century I have taken a keen interest in the industrial aspects of micro-biology, and during that time have, of course, witnessed enormous advances in our knowledge, and in the practice based thereon. At the same time I have felt very strongly that the contribution made by this country to a branch of study the encouragement and development of which are of such high national concern, has not been such as to redound to our credit—especially when regard is had to our outstanding position as an industrial nation and to the vastness of our Empire and of our resources. It was for that reason that in 1919, at the meeting of the Society of Chemical Industry to which I have referred, I advocated as strongly as I could the foundation of a National Institute of Industrial Micro-biology, and since then, on a number of occasions, I have publicly reiterated the suggestion. Thus, at a joint meeting of the London Section of the Society of Chemical Industry and the Biochemical Society held in January 1923, at which I had the honour to preside, the whole question was fully discussed, and it was resolved on a motion of Sir William Pope that the Society of Chemical Industry and the Biochemical Society should combine to secure the establishment, with adequate financial and executive resources, of a National Institution of Industrial Micro-biology. To these Societies I should hope that I might add the Royal Microscopical Society. Referring to this meeting, the Brewers' Journal in June 1923 said: "The existence of such a vast range of industries all dependent on vital processes, but at present so isolated one from the other that the discoveries of one may easily be overlooked by another to whose benefit they could readily be applied, is a very strong argument in favour of a central institution at which the basic problems could be studied without the dissipation of energy and overlapping that so easily arise in disconnected research. It is impossible to go far in the industrial application of science until the fundamental problems are thoroughly worked out. Such work is undoubtedly of the utmost national and technical importance, and could be most readily carried out at an institute such as was proposed. In such a scheme the brewing industry would naturally take a leading part, as it is its proud boast to have provided many of the pioneers of micro-biological research, and its privilege to share in large measure in the far-reaching results that have arisen out of their work."

Although I have dealt with my suggestion in detail in previous papers, I may perhaps be permitted to refer briefly to some of the more important functions which a National Institute might be expected to fulfil.

First and foremost it would provide for the systematic prosecution of research in connection with all those numerous industries in which micro-organisms, or the enzymes they secrete, play an important part. At present a great deal of very valuable work is being done at various centres and institutions in this country, but there is a lack of co-ordination and an absence of "team work" of the kind which the existence of a central institution and the labours of a number of workers under one roof would render possible, or at least facilitate. In this way, and perhaps in this alone, will some of the really big industrial problems which await solution be successfully attacked. We are a nation of individualists, and how much may be done by individual effort, or by a limited degree of co-operation, is well illustrated by the brilliant work and the far-reaching results recently obtained by our former President, Mr. J. E. Barnard Still, even several swallows do not make a summer, and although I am myself a confirmed individualist, I feel that devotion to individualism, in the present phase of scientific development, may be carried too far. The late War supplied many examples of the advantages accruing to applied science through the intensive application of team-work to the solution of problems of national importance, and so long as the rights of the private worker are respected, much good may result from centrally directed co-operation of the kind represented by the activities of the Department of Scientific and Industrial Research.

In the next place it would serve as a centre for the specialized training of men intending to devote themselves to the teaching of micro-biology and biochemistry in our Universities and Technical Schools. There is an increasing demand for men possessing special knowledge of micro-biology as applied to Industry, and outside of a comparatively small number of laboratories there are not any facilities for instruction of this kind.

It would also afford opportunities for the instruction of factory managers and other technical employees engaged in the biological industries. Here, as in the case of intending teachers, the practical man finds very great difficulty in obtaining the knowledge he requires given by a man who has himself a thorough and first-hand acquaintance with the particular subject in question.

Then it would provide breweries, distilleries and other factories with any required organisms in pure culture, and in sufficiently large quantities for industrial purposes. In Germany there is the Institut für Gärungs Gewerbe in Berlin; in France the "Service des Levures," a special department of the Pasteur Institute, and several private institutions; and in other countries there are institutions or firms who make a practice of supplying pure cultures to brewers, distillers, wine-growers, cider-makers, dairy managers and other manufacturers; but in this country such facilities do not, so far as I am aware, exist. It may be said that there is no great demand, but the essence of my argument is that with extended knowledge and research the demand would inevitably increase, and we should become manufacturers where to-day we are only importers or middlemen, or to take the lowest platform we should at least do better that which to-day we are doing only indifferently well. To take the brewing industry—a good many years ago the claims of pure yeast were considered, and after a careful study of the matter it was decided that having regard to the need for providing for cask conditioning, single-cell yeast could not be employed with advantage. Even if that was true the conditions to-day have changed owing to the enormously increased demand for chilled and filtered beers, where secondary fermentation or "conditioning," so far from being a desideratum, is a positive disadvantage. I could give many instances of the good effects such facilities would have in the development of the biochemical industries, if time permitted.

The proposed institute would serve to house as complete a collection of industrial micro-organisms in pure culture as could be got together. Although there are several collections of micro-organisms in this country, there is nothing of the kind I have in mind—that is to say, a collection comprising organisms whose industrial characters are well known, and which could be supplied at a moment's notice for the use of any manufacturer who might desire to obtain certain results. In passing I should like to pay a tribute to the work done by Dr. Ledingham and Dr. St. John Brooks in getting together the National Collection of Type Cultures at the Lister Institute; but good as this, and other collections are, they fail just where from the industrial point of view they should be of the greatest use. They do not cater for the manufacturer, and on the other hand, they are not by any means complete enough to be of real value to investigators for purposes of indentification and research.

Finally, the institute should serve as a central home for British micro-biological science. It will be seen that I have dealt only with micro-biology in its relation to industry, chiefly because it is the aspect with which I am most familiar; but from letters which have recently appeared in the Press it would seem that an institute such as I have advocated might quite well supply the need expressed by Professor Castellani for a central institution in which cultures of the lower fungi (other than bacteria) having pathogenic properties could be investigated botanically, and be properly identified and classified. Medical bacteriology is well provided for, but so far as I am able to gather, medical mycology appears to be in need of a good deal of attention and help. I have, I think, said enough to show what sort of an institution I have in mind and what useful purposes it might serve. I know well enough that the two main difficulties are to find the necessary money and the right men. There should not, however, be any real difficulty in making a beginning in a modest manner, and allowing the institution to grow, as I am confident it would. A large and expensive building would not be necessary or desirable in the first instance, and it is probable that some existing house of sufficient size, preferably in proximity to one of our University Colleges, would be available. So far as industrial micro-biology is concerned, I believe that after a very short period of nursing such an institute would be practically self-supporting, and it would certainly be a first-class national investment. I feel, however, that to be a success it should be a *separate national institute*, and not a mere department of some existing teaching institution. Since I last spoke on this subject there has been an exceedingly interesting and important development of the activities of our Society, which has a close bearing upon the matter; I refer, of course, to the formation of the Section of the Society devoted to the industrial applications of the microscope. This Section, the formation of which was authorized by the Council in October 1922 for the purpose of assisting in the development of scientific research in British industries, so far as that development is dependent on the use of the microscope, has been a very great success, and has, I think, more than fulfilled the expectations of those who were chiefly responsible for its inception. In the short period during which it has been in existence it has dealt with a number of highly interesting and important subjects covering a wide field. Thus, the applications of microscopy to Agriculture, Metallurgy, Coal, Petroleum, the Fermentation Industries, Photography, the Cotton, Linen and other textile industries, Leather, Paper, Soap, Cement, Gas Mantles, Timber Pathology, Bee-Keeping and certain Industrial Diseases, have all received attention, and have provided the occasion for much useful discussion. The Committee have endeavoured to arrange that each evening shall, so far as possible, be devoted to some special industry, a policy which cannot fail to add to the success of the meetings. In this connection I might refer to the joint meeting with the Institution of Structural Engineers which was held during the past Session, and which it is to be hoped will prove the forerunner of other joint meetings of a similar character. Through these the microscopist will learn more of the needs and problems of certain industries, and the representatives of those industries, on the other hand, will, as the result of informal discussion and closer co-operation, be led to appreciate more fully the help which the trained microscopist can render.

I should now like, with your permission, to refer very briefly to one or two matters of what I may describe as domestic interest. During the past year the Council took a step which marks an epoch in the history of our Society. I refer, of course, to the holding of the Conference at Sheffield. A full description of the proceedings has appeared in the pages of our Journal, and I need not say more this evening, than that this departure was generally felt to have been very thoroughly justified, and that I personally consider that I am entitled to congratulate myself that this event should have occurred during my term of Presidency. I firmly believe that such Conferences (for others will surely be held) cannot fail to exercise a powerfully stimulating effect upon the development of that branch of pure and applied science which it is the special function of our Society to represent, and which we all earnestly desire to advance by every means in our power. The history of our Society is a long record of sound scientific work of the highest interest, and often of great practical utility, carried out quietly and unostentatiously, but with results of which all concerned may justifiably be proud. Just as its venerable parent, the Royal Society, had its origin in the meeting of "certain vertuous and learned men in Dr. Wilkins his lodgings in Wadham College, Oxford," so the Royal Microscopical Society had its origin in informal meetings of a similar character, and since these gave birth to the corporate body in 1839 the Society has continuously and successfully striven to promote the objects with which it was formed. In our present Bye-laws as revised at a special meeting held in 1921 these are concisely stated to be "the promotion of Microscopical and Biological Science by the communication, discussion, and publication of Observations and Discoveries relating to (1) Improvements in the Construction and mode of Application of the Microscope, or (2) Biological or other subjects of Microscopical Research." Those Fellows who have been present at the ordinary meetings of the Society, or those of the Biological Section, will know how well the aims and objects stated under the above two headings have been kept in view and promoted. I know of no scientific Society whose meetings are better attended in proportion to its membership, or whose proceedings are characterized by a greater degree of vitality. This, however, brings me to a point on which I feel that I cannot touch with quite so much satisfaction. I refer to our numerical strength. A reference to the Report of the Council shows that, after allowance has been made for our losses, our membership has remained practically stationary during the past year, and that we have on our register the names of 497 ordinary and 16 honorary Fellows. With the very natural desire of a President to report that everything is for the best in the best of all possible Societies, and giving full weight to the fact that our register is in no way fictitious, but is an accurate statement of our effective membership, I cannot help expressing my feeling that the position is not altogether satisfactory. In this connection it may be of interest to record the total membership at the end of the years 1895, 1905, 1915, and of the current year respectively. They are as follows:—

Year.	Total No. of Fellows.
1895	627
1905	456
1915	435
1925	513

On referring to the above numbers it will be seen that our register contains at present the names of even fewer Fellows than at the end, say, of 1895. On the other hand—and this is a matter for satisfaction—there has been a more or less steady increase during the last fifteen years.

For a Society devoted to a branch of science so important, and having such immensely wide applications, this state of affairs cannot be regarded without a feeling of disappointment. Several causes have no doubt operated against a greater and more rapid accession to our strength, foremost among which is, perhaps, the ever-increasing number of specialized Societies, and the natural disinclination of many scientific men to increase their already long list of subscriptions. However that may be, it is to be hoped that every member will endeavour to bring before his friends the outstanding claims of our Society, and to secure the inclusion of all who come within our qualifications and are otherwise eligible.

I am now approaching the end of my Address, and with it the end of my term of office as your President. When two years ago you conferred upon me the greatest honour which it was in your power to bestow, I entered upon my duties with a full sense of the difficulties and responsibilities attaching to the office. I felt, however, that I was assured of the support and indulgence of the Officers and Members of Council, and indeed of the whole body of Fellows; and I knew that I could count upon the ever-ready help and assistance of our Secretary, Mr. Lock, and above all of our Past-President, Mr. Barnard. How much I needed such support and help I need not perhaps tell you; but I can only say that I have throughout the whole of my term of office met with the greatest kindness and friendliness on every hand. For this I am very grateful.

I now come to my last and very pleasant duty, and confidently anticipating the result of the ballot welcome my friend Dr. Murray as my successor in the Presidential Chair. Of Dr. Murray's eminence as a microscopist it would be presumption for me to speak, and of his past services to the Society I need say but little, as they are so well known to you all. I may perhaps just recall that for the past five years he has acted as one of our Honorary Secretaries, and in that capacity has rendered the Society yeoman service. That he possesses in a high degree those personal qualities which go to the making of a good President is well known to all, and in handing over to him the reins of office I know that the future of the Society could not be in safer or more competent hands.

II.—OTOLITHS OF LARGE EELS FROM THE ALBUFERA OF VALENCIA.

By Dr. A. Gandolfi Hornyold, F.R.M.S., F.Z.S.

(*Read October* 21, 1925.)

Three Plates.

During the course of my work on determining the age and growth of the eel by their scales and otoliths, I had noticed that in large eels the form of their otoliths showed a considerable variation.

I did not carry out further investigations till I met Mr. G. Allan Frost, who kindly initiated me into the study of otoliths and showed me his unique collection.

It is a great pleasure for me to thank him most sincerely, as also for revising this paper.

These investigations were carried out in the Spanish Hydrobiological Laboratory at Valencia during the month of May. All the eels were silver females, and the following table gives their length, weight and dimensions of their otoliths:—

Length	Weight	Dimensions of Otoliths	
cm.	gr.	mm. mm.	mm. mm.
111	2350	3·75 × 2·75	3·75 × 2·75
106	2310	4·75 × 2·75	4·75 × 2·75
99	1650	5 × 3	5 × 3
97	1830	6·25 × 3·25	5·25 × 3·25
97	1160	4·75 × 2·75	4·75 × 2·75
92	1125	4·75 × 2·75	4·75 × 2·75
88	1800	4·75 × 2·75	4·75 × 2·75
88	1170	5 × 3	5 × 3
83	980	4 × 2	4 × 2

The saccular otolith, the sagitta, is used to determine the age of the eel, the other two otoliths, the asteriscus and lapillus, are very small.

These also seem to show some differentiation in their form, and I hope to be able to study them later.

The table confirms previous observations on the dimensions of otoliths of large eels.

Those of eels of the same length may differ more or less in size, as in the case of the two 97 cm. females: the otoliths of one measure 6·25 × 3·25 and 5·25 × 3·25 mm.; those of the other 4·75 × 2·75 and 4·75 × 2·75 mm. The otoliths of the two 88 cm.

eels show a similar variation in size, and the otoliths of one measure 4·75 × 2·75 and 4·75 × 2·75 mm., and those of the other 5 × 3 mm. and 5 × 3 mm.

The size of the otolith is not in absolute proportion to the length of the eel, though naturally the otoliths of a small eel of say 40 cm. would be smaller than those of an eel 80 cm. long. The 9 silver females measured 83–111 cm., and the otoliths of the 111 cm. eel were the smallest of all, 3·75 × 2·75 mm., and the 99 cm. and one of the 88 cm. eels had otoliths of the same size, 5 × 3 mm.

Usually both otoliths are of the same size, but they can also differ, as in the case of the 97 cm. and 1830 gr. eel, whose one otolith measures 6·25 × 3·25 mm., and the other 5·25 × 3·25 mm. It is the first time that I have observed such a difference in size.

Miss Carmen Simon, of the Spanish Hydro-biological Laboratory, made the drawings of the otoliths, using a Reichert binocular microscope with a 50 mm. objective and eye-pieces 2 and 4, which give a magnification of 18 and 27.

Mr. G. Allan Frost has most kindly examined a large number of eel otoliths, and describes them as follows —

The saccular otolith, the sagitta, in the young eel is ovate or round in shape, usually with a flattening of the frontal rim.

The outer side is slightly concave, and the inner side is convex.

The sulcus is oblique and straight.

In the adult eel the form is elongated, the dorsal rim curved or straight, the ventral rim is slightly curved, the posterior rim is usually pointed, and the front consists of a rostrum, antirostrum and an excisure. The sulcus opens widely on the frontal rim, the ostium is slightly depressed, and the cauda, which is usually narrow, may be curved or straight. In some cases the sulcus widens out, and is not divided into ostium and cauda. The sulcus does not usually reach the posterior rim.

There is considerable differentiation in the forms presented in the otoliths of adult eels. The utricular and lagenar otoliths are very small in comparison with the sagitta.

The left otolith of the 111 cm. eel (fig. 1) is elongated, the dorsal and ventral rims slightly curved. The posterior rim has a slightly rounded protuberance and does not end in a point.

There is no antirostrum or excisure, and the rostrum is large and blunt.

The sulcus opens widely on the dorsal part of rostrum, and is not divided into ostium and cauda; it is slightly curved and very deep, ending at about four-fifths of length of otolith.

The form of the right otolith (fig. 2) is rather similar; it is elongated, both dorsal and ventral rims are slightly curved; the dorsal rim forms a point with a small notch below it.

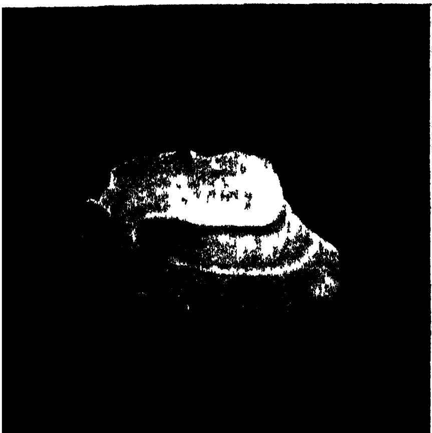


fig 1

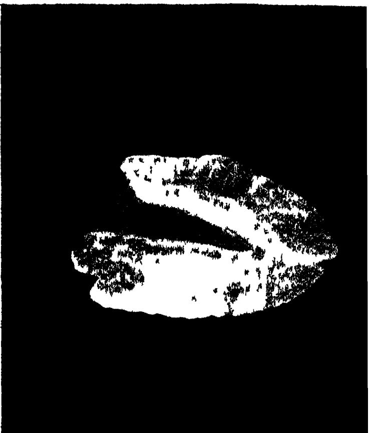


fig 2

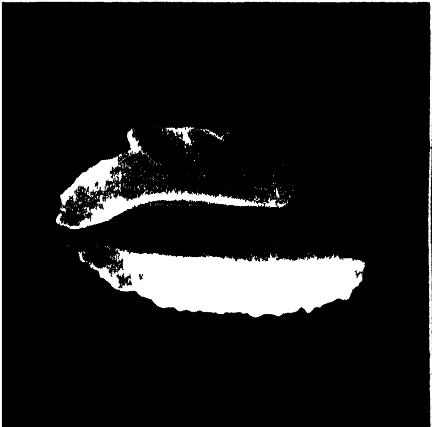


fig 3

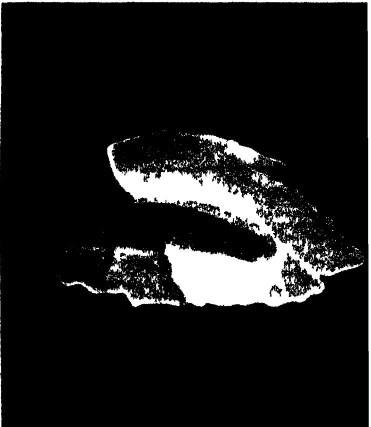
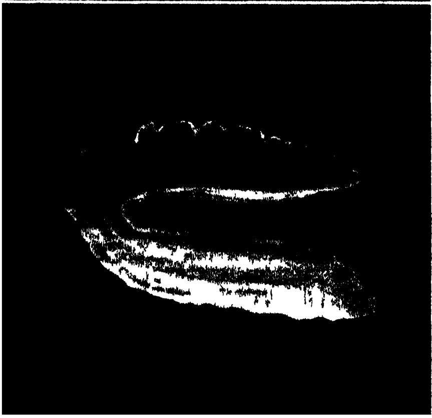
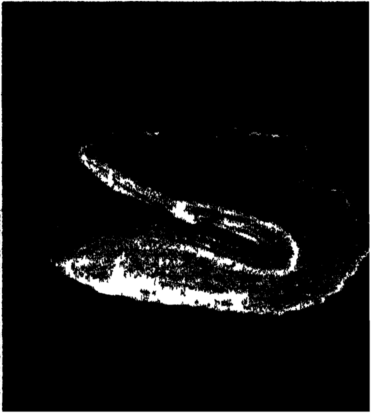


fig 4





The antirostrum is small, and the rostrum forms a protuberance with a large notch below.

An excisure is present, the ostium opens out very widely, and the cauda ends at about two-thirds of length of otolith.

The sulcus is nearly straight, is less deep than in the left otolith, sloping down gradually and forming ridges.

The left otolith of the 106 cm. eel (fig. 3) is elongated, the dorsal rim more curved than the ventral, and posterior rim is rounded with a small notch above termination of sulcus.

Antirostrum blunt, rostrum large and pointed. Excisure present.

The undivided sulcus opens widely on dorsal part of rostrum; it is wide and straight till about two-thirds of length of otolith, when it gradually tapers, ending on a rounded protuberance between two notches on dorsal rim.

The right otolith (fig. 4) is elongated, the dorsal rim is curved, the ventral rim nearly straight, and the posterior rim ends in a point with a small notch below.

Both antirostrum and rostrum are very large and pointed. The excisure is large, and antirostrum and rostrum form practically a right angle.

The undivided sulcus opens out widely on to dorsal part of rostrum, and is nearly straight, ending rounded at about three-quarters of length of otolith.

The left otolith of the 99 cm. eel (fig. 5) is elongated, the dorsal rim is slightly curved, with various indentations, the ventral rim straight, and the posterior rim obtuse.

Both antirostrum and rostrum are large, as also the excisure; the first is pointed and the second rounded.

The sulcus opens widely on the dorsal part of rostrum, and is not divided into ostium and cauda; it is straight, deep, and on ventral side slopes down gradually, forming wide ridges; on the dorsal side the ridges are much narrower.

The right otolith (fig. 6) is also elongated; both dorsal and ventral rims would be straight but for very large indentations at about three-quarters length of dorsal rim, which give a snake-like appearance to ventral part of same.

Antirostrum and rostrum large, the first forming a blunt point and the second rounded.

An excisure is present, the ostium opens out widely, and the cauda ends rounded at about four-fifths of length of otolith.

The sulcus is nearly straight, and slopes down gradually, forming ridges of similar width on both dorsal and ventral sides.

The deep part of sulcus forms a narrow channel.

The left otolith of the first 97 cm. eel (fig. 7) is elongated, the dorsal rim is very slightly curved with various indentations, the ventral rim is straight, and the posterior rim has a large rounded protuberance divided by a deep notch.

The antirostrum forms a small rounded protuberance, the rostrum is very large and fairly pointed. The excisure is large.

The undivided sulcus is straight, and ends at about five-sixths of length of otolith, sloping down gradually and forming ridges on the dorsal side and end.

The right otolith (fig. 8) is smaller and elongated, the dorsal rim curved with various indentations, the ventral rim is straight, and the posterior rim has a small flattened protuberance, with a small notch below.

Both antirostrum and rostrum large and fairly pointed, and the excisure forms a right angle between them.

The ostium is narrow, and the cauda ends in a rounded point at about five-sixths of length of otolith.

The sulcus is curved and deep, the dorsal side slopes down, gradually forming ridges.

The left otolith (fig. 9) of the second 97 cm. is slightly elongated, the dorsal rim is straight, and the ventral rim curved with various indentations.

The posterior rim has a flattened protuberance, with a small notch in centre.

There is neither antirostrum, rostrum, nor excisure, and the undivided sulcus opens fairly widely on front rim.

The sulcus is deep, slightly curved, with ridges on both dorsal and ventral sides; its ends rounded at about four-fifths of length of otolith.

The right otolith (fig. 10) is elongated; both dorsal and ventral rims are nearly straight, with small indentations. The posterior rim is rounded, ending with a small rounded protuberance.

There is no antirostrum nor excisure, and the undivided sulcus opens very widely on dorsal part of rostrum.

The sulcus is practically straight, and has ridges on both dorsal and ventral side, ending rounded at about three-quarters of length of otolith.

The left otolith of the 92 cm. eel (fig. 11) is elongated, the dorsal rim slightly curved, with various indentations, the ventral rim is straight, and the posterior rim forms a point.

The antirostrum is a very small pointed protuberance, the rostrum is obtuse. There is no excisure, and the sulcus, which is not divided into ostium and cauda, opens widely on the frontal rim. The sulcus is deep, slightly curved, and ends in a point quite close to the posterior rim. There are a few ridges on the dorsal side.

The right otolith (fig. 12) is elongated, the dorsal rim is slightly curved, with various indentations and crystallizations; towards the posterior rim there is a large notch. The ventral rim is straight and the posterior rim is rounded. The antirostrum is a small

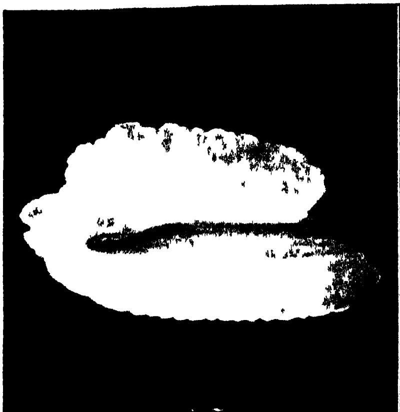
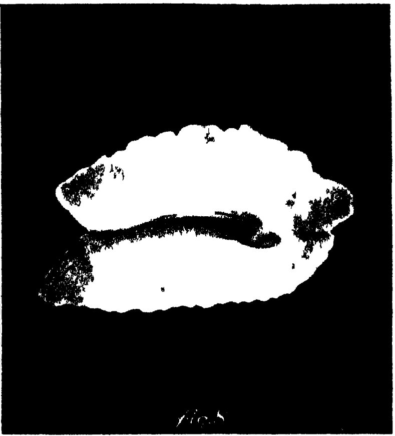


fig. 7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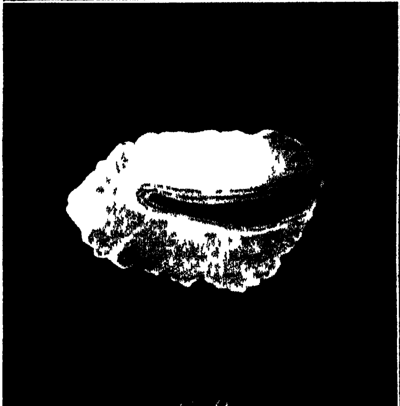


fig. 9

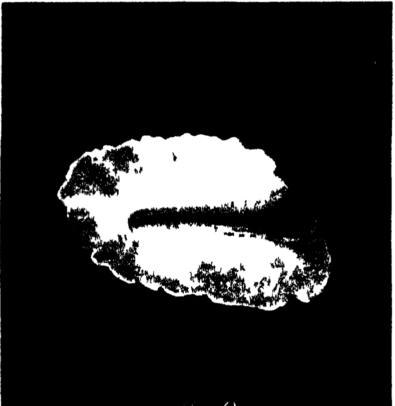
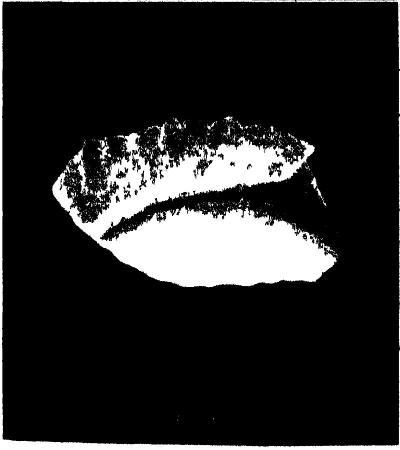
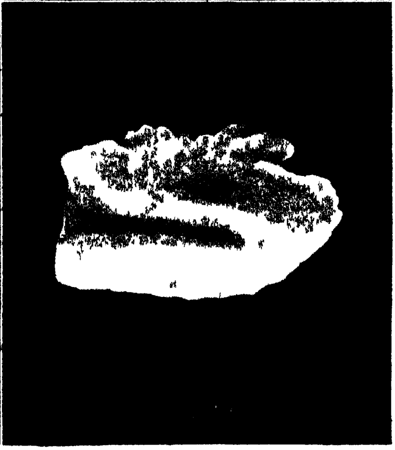


fig. 10





rounded protuberance; there is no excisure, and the rostrum is just indicated.

The opening of the sulcus, which is not divided into ostium and cauda, covers the whole of the frontal rim.

The shallow, straight sulcus has a constriction near the end, and terminates rounded near posterior rim.

This otolith is probably a pathological form.

The left otolith of the first 88 cm. eel (fig. 13) is elongated, the dorsal rim curved, with deep indentations, the ventral rim nearly straight.

The dorsal part of posterior rim forms a large rounded protuberance, with a large notch below.

The antirostrum is small, ending like the rostrum in a blunt point. An excisure is present, and the form of the sulcus is quite abnormal; it is confused and quite unlike that of other otoliths.

The right otolith (fig. 14) is elongated, the dorsal rim is very slightly curved, the ventral is straight, and the dorsal rim is terminated with a small rounded protuberance.

Both antirostrum and rostrum are pointed. An excisure is present. The sulcus is curved, opening widely on frontal rim of otolith; it narrows gradually till about four-fifths of length. when it widens out again, opening widely on the posterior rim.

The sulcus is undivided and deep, and has various ridges on the dorsal side; toward the end there is a very wide one which reaches the posterior rim.

The left otolith of the second 88 cm. eel (fig. 15) is elongated, the dorsal rim is curved, the ventral straight. The posterior rim has a large rounded protuberance.

The antirostrum is obtuse, as also the rostrum, which is very large; an excisure is present, and the antirostrum and rostrum form a right angle.

The undivided sulcus opens widely on the frontal rim. and is very shallow, except for a narrow channel in the centre, sloping down gradually and forming ridges on both dorsal and ventral sides. The sulcus is straight, and ends rounded at about three-quarters of length of otolith.

The right otolith (fig. 16) is elongated, the dorsal rim is curved, the ventral straight. The posterior rim has a small rounded protuberance, with a notch above and below, as also various indentations.

Both antirostrum and rostrum are obtuse; the former has a small notch in centre. An excisure is present, and the antirostrum and rostrum form a right angle.

The undivided straight sulcus opens out widely on the frontal rim, covering the greater part of same. It is deep, and ends at about five-sixths of length of otolith, with various ridges on the dorsal side.

The left otolith of the 83 cm. eel (fig. 17) is elongated, both dorsal and ventral rims straight, the latter elevated posteriorly. The posterior rim is serrated and pointed.

The antirostrum is small and rounded, and the rostrum forms a rounded protuberance, with a small notch above and a larger one below.

An excisure is hardly discoverable.

The sulcus, which is undivided, is depressed anteriorly, the remainder being straight, opens out widely on frontal rim, and ends rounded at about two-thirds of length of otolith. There are a few ridges on dorsal side near the end.

The right otolith (fig. 18) is elongated; both dorsal and ventral rims are straight; the latter has many indentations. The posterior rim is pointed and serrated.

The small antirostrum is pointed, the rostrum rounded, with a small notch below. The excisure is rectangular.

The straight undivided sulcus opens out widely on dorsal part of the rostrum, and ends rounded close to posterior rim. It is very wide and deep.

These observations show that there is not only a very considerable differentiation in the form of the otoliths of large eels, but that in the same eel each otolith may also show more or less differentiation in the form, in that of the sulcus, or in both.

The most interesting fact is, that several of the otoliths have a distinctly clupeoid type, as Mr. G. Allan Frost, who kindly examined the drawings, observed.

His description of the clupeoid group of otoliths corresponds to several of the otoliths, such as figs. 3, 4, 5, 6, 7, 8, 15, 16, 17, and 18.

Rostrum, antirostrum and excisure present the sulcus wide and open, undivided, or with a slight angle of lower line.

The clupeoid, or herring type, seems to be the normal type for large eels, and this is of great interest for the origin of the eel.

The right otolith of the 88 cm. and 1300 gr. eel (fig. 14) has a very curious form, and its dorsal area is very similar to that of *Beryx splendens*, a percoid fish of the Berycidæ family.

The eel is perhaps one of the longest-lived fishes, and large eels may be of considerable age, but it is not possible in most of such cases to tell their age by their otoliths.

There is also a very considerable variation in the growth of eels, even in the same waters. I have examined the otolith of about 1000 eels from the Albufera of Valencia.

A 100 cm. silver female eel was in its thirteenth year, but another only 65 cm. long was in its sixteenth.

One must add to the age the three years of its larval life, and

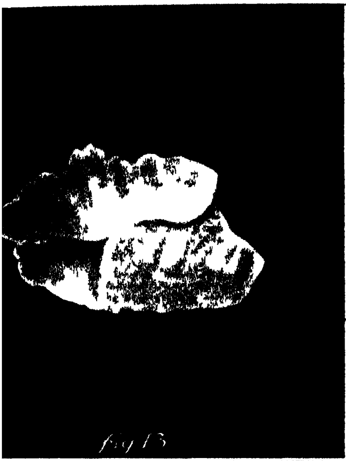


fig 13

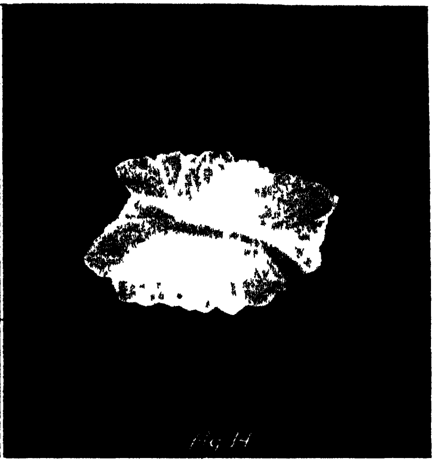


fig 14

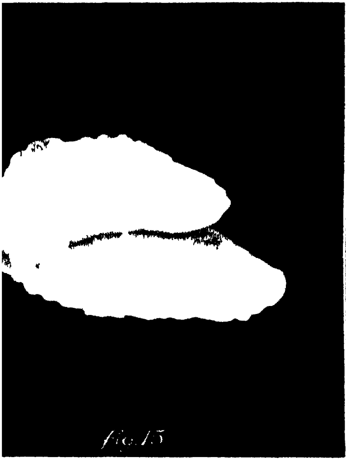


fig 15

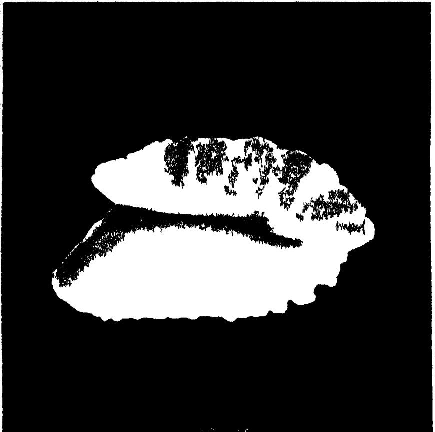
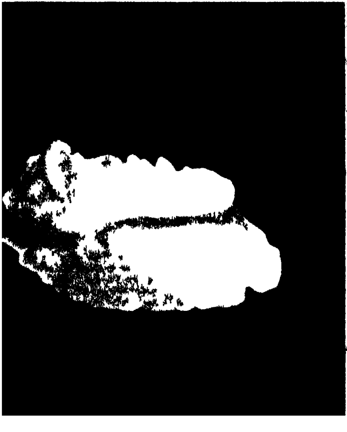
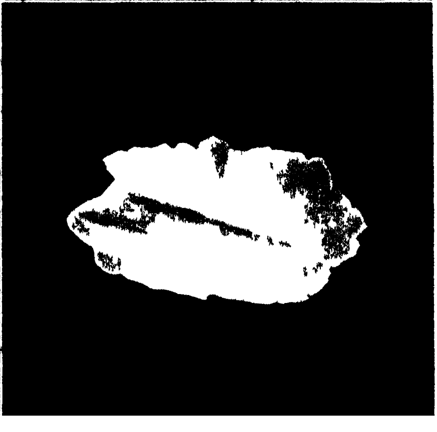


fig 16





I have seen eels from the Albufera with sixteen to seventeen zones on their otoliths.

The French naturalist Dareste kept an eel in captivity for thirty-six years, and a sardine manufacturer in Spain has kept two eels for over thirty years. One does not know the age of these eels when captured, but I think that under favourable conditions an eel might live over forty years, perhaps even longer.

In rivers the eel has not a very rapid growth, and one can conclude that such large eels as the Frank Buckland models in the Science Museum, South Kensington, have a considerable age, and their otoliths would be most interesting.

I did not determine the age of the eels mentioned in this paper, as it would have been necessary to have ground down the otoliths, which, as this would have removed the sulcus, was impossible. The 111 cm. was probably not far off twenty years of age, and I have noticed that in such irregularly shaped otoliths it is often quite impossible to count their zones, in other cases only with great difficulty. I have seen also cases of pathological modification of otoliths which have a curious opaque appearance. Usually this takes place in one of the otoliths only, the other remaining quite normal, but I have seen one or two cases where both otoliths were affected.

Such otoliths look as if they had been attacked by some acid.

Crystallization also seems to produce modifications in some otoliths.

Dr. G. T. Prior, of the Natural History Museum, kindly examined some eel otoliths for me, and found that they were composed of aragonite and calcite, also organic matter.

Possibly the proportions may change with age or from other causes.

I have noticed that in fast-growing eels with a small number of zones on the otoliths (which are usually transparent in creosote, etc.) that their form is clupeoid, apparently the normal form for large eels. Perhaps in some cases modifications of the form of the otoliths may take place in older eels of slow growth or with age.

III.—THE THEORY OF DIMENSIONS IN MICROSCOPY.

By F. Ian G. Rawlins, M.R.I., F.R.M.S.

(Read December 16, 1925.)

In common with other branches of Natural Philosophy, physical and geometrical optics are subject to the laws of dimensional reasoning, and therefore the science of Microscopy is itself to a large extent guided by the necessity for a consistent system of units, or as it is sometimes called the Principle of Similitude.

It is the aim of this short paper to clear up sundry points in everyday use, and to submit them to rigorous expression on a dimensional basis. As far as the writer is aware, this has not been done before from a purely microscopical standpoint. In the usual way it is assumed that physical magnitudes can be expressed in terms of three fundamental units, namely, those of Length [L], Mass [M], and Time [T]. Fortunately we are not concerned with the concept of temperature and the difficulty of bringing it into a rational scheme of dimensional usage. Although the microscopist is not directly concerned with mass, it will be necessary to include it in the sequel.

Probably for the work in hand the most important magnitude is that of length. Tube-length, working distance, focal length, radius of curvature, are all of dimensions [L]. The "power" of a lens, frequently measured in dioptres, is the reciprocal of its focal length, and is therefore of dimensions $1/L$ or $[L]^{-1}$. This fact brings to light the unsuitability of the term "power." In dynamics, and really throughout all exact thought, power is defined as the rate at which a system does work, and is consequently of dimensions $[M]\,[L]^2\,[T]^{-3}$. The choice of the word in optics is unfortunate.

For the microscopist there are a number of magnitudes of dimensions zero (i.e. mere numbers or numerics) of considerable importance. These embrace all the trigonometrical functions, the numerical aperture, the convergence, and magnification. It is well to notice the case of the N.A. ($n \sin a$ in the ordinary notation). n is the ratio of two velocities, and therefore a mere number. Sin a is equal to the sum of a certain infinite series, and is thus a numeric. Hence the nature of the N.A.

We have now to consider the more physical (in contrast to geometrical) quantities met with in microscopy in their dependence upon dimensional theory. An important instance is that of birefringence. It is expressed as the difference of two indices of refraction. Since both these are numerics pure and simple, so is their difference. Amongst physical magnitudes of the nature of a length may be mentioned the retardation met with in interference phenomena, and obviously wave-length itself. Resolving power, on the other hand, is of dimensions $[L]^{-1}$, since this quantity increases as the distance between two points which it is possible to observe diminishes. Finally, in anisotropic media it should be noticed that the axes of the ellipsoids are only proportional to the velocity of propagation of the rays passing through. To obtain equality a coefficient of the dimensions of time is needed. Writers on physical, and even more on chemical, themes are often offenders against mathematical rigour in the demand that equations shall balance dimensionally.

It would not be difficult to multiply examples in which the nature of a magnitude is important in theoretical work; but these have been put together in the hope that they may conduce to clear conceptions of fundamentals on the part of those whose chief use of the microscope is as an instrument of routine.

IV.—A NEW MICROSCOPE.

By M. T. DENNE, O.B.E., F.R.M.S.

(*Read November* 18, 1925.)

TWO PLATES.

THE primary object in view when this design was being worke out was the provision of a full-sized optical bench below the stag of the microscope, so that the condenser and illuminant could b adjusted and manipulated conveniently without the restriction imposed by the limited distance between the stage and the tabl in the ordinary instrument, and so that direct illumination withou the use of the mirror could be employed with the microscope set a any angle.

It is not practicable when an instrument of the usual type i set at or near the vertical to find room for an optical benc 12 inches or more in length, unless the work-table is cut away o the eye-piece position unduly elevated; so that it became necessar to arrange for a skeleton work-table adjustable for height to allo access to the optical bench and its saddles.

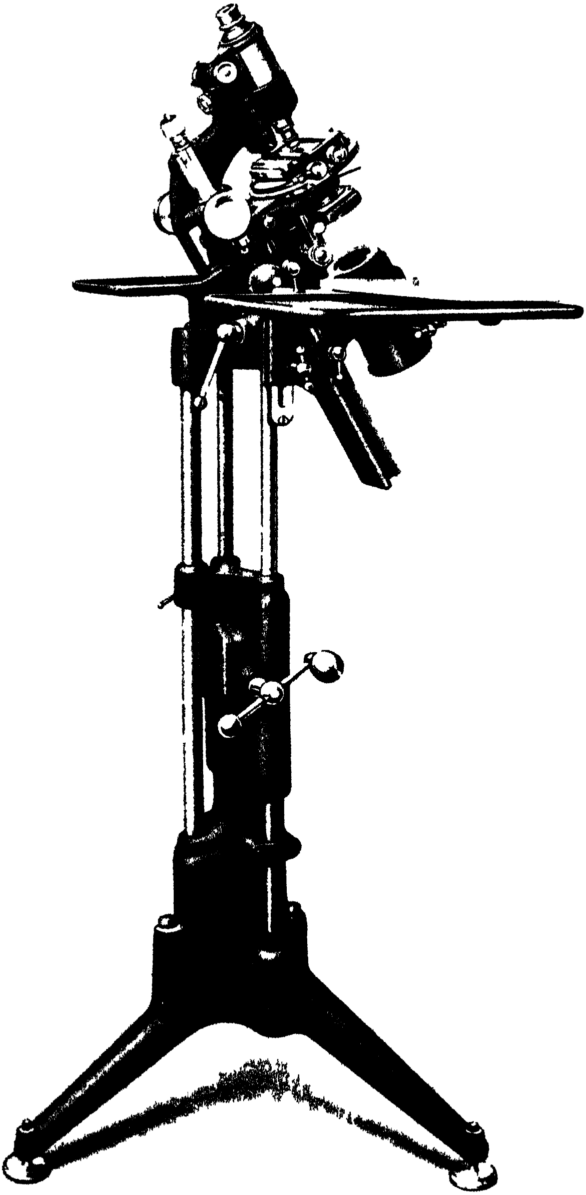
The present design is the result of an endeavour to give faciliti for the proper use of the optical bench, and also to permit of th eye-piece position being adjusted through a vertical range suffic ently great to give a comfortable position with the optical axis the instrument at any angle or set vertically.

It will be noted that the limb is on the Powell model; it securely attached to a long coarse-adjustment slide in the form a triangular bar of heavy section moving in ways behind the optic bench, and operated by milled heads of large diameter.

This slide has special provision for taking up wear, consisti of hardened steel slips, screw-pressed. The limb, slide, and bo are balanced as a unit to permit of smooth and easy action.

The fine-adjustment operates the nose-piece only. The latt is borne on the dovetail slide at the lower end of the limb, a is connected through a link having spherical highly polish bearing surfaces to a long lever mounted within the limb. T micrometer screw bears on the free end of this lever. The scr has an additional bearing in a hardened steel collar, so that lateral strains are transmitted from the hand to the delicate n and screw.

The milled head is divided into forty divisions, each divisi being equivalent to a movement of 1 μ in the nose-piece.



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This slide has special provision for taking up wear, consisting of hardened steel slips, screw-pressed. The limb, slide, and body are balanced as a unit to permit of smooth and easy action.

The fine-adjustment operates the nose-piece only. The latter is borne on the dovetail slide at the lower end of the limb, and is connected through a link having spherical highly polished bearing surfaces to a long lever mounted within the limb. The micrometer screw bears on the free end of this lever. The screw has an additional bearing in a hardened steel collar, so that no lateral strains are transmitted from the hand to the delicate nut and screw.

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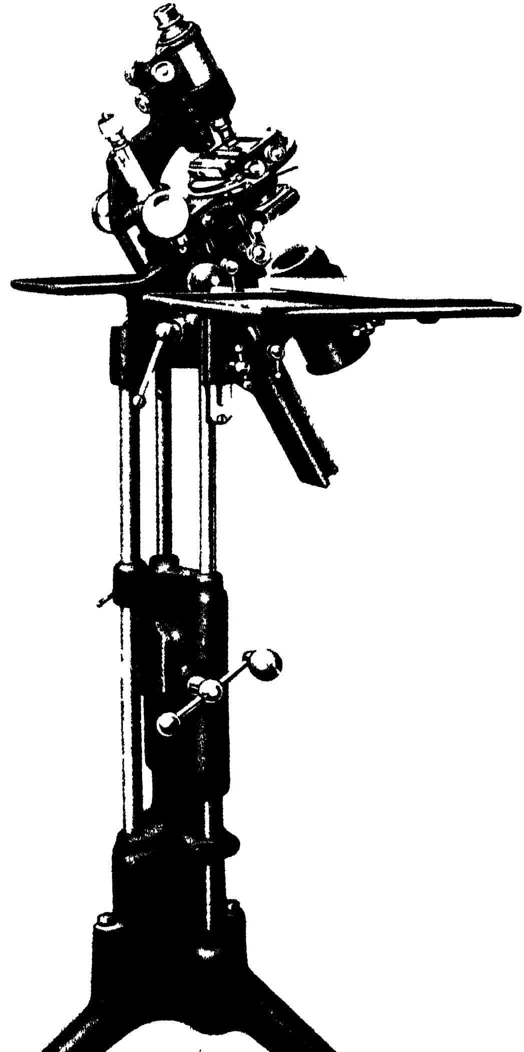

Two bodies are provided, one for the short and one for the long tube; the former has a sliding rackwork draw-tube, and the latter a rackwork tube only.

The rackwork draw-tubes are supported on additional sliding bars of large diameter, making for rigidity when fully extended.

The mechanical stage is mounted as a separate unit on the upper end of the optical bench, and can be replaced by a plain stage.

The centring sub-stage is also carried upon a saddle on the bench, and bears a horseshoe fitting for the Akehurst condenser changer. It is provided with rack coarse-adjustment and lever fine-adjustment.

The supplementary condenser and lamp are also carried on saddles upon the bench.

The optical bench is of heavy section and is 14 inches in length. The saddle blocks for apparatus are held by eccentric-ended bolts, and are quickly removable.

The support for the optical bench and the limb with its fitting consists of a cradle having massive trunnions in bearings upon a triangular web borne upon three steel rods. The supporting rods slide in corresponding holes in the pedestal, the latter having three arms provided with hardened steel pads resting upon the floor.

The cradle upon its rods is adjusted for height by means of a balanced worm gear, and the whole is constructed so that lifting the load is easily effected by a hand-wheel without effort.

The three rods are clamped simultaneously by jaws operated by one clamp screw, and when clamped form an absolutely rigid framework.

In substitution for a work-bench, trays are fitted on each side of the instrument. That on the left is elevated or lowered with the microscope unit; but the right-hand tray has an independent elevating motion, and also a movement about a horizontal axis, so that its surface may be set at any angle with the optical axis of the microscope. This enables it to be used to support a drawing-board for Camera Lucida work. The drawing-board and its holder may be placed in position in a clamp fitting above the table, in such a manner that an angular setting may be obtained around a second horizontal axis at right angles to the first.

In this way the drawing surface has universal adjustments to suit Camera Lucida work.

The base supporting the whole apparatus is heavy, and the levelling screws have spherical polished and hardened surfaces, so that the instrument may be moved over the floor with ease.

The great rigidity of the whole, the possibility of securing extremely accurate centring of the units upon the bench, the ease with which the head may be adjusted for eye-piece position, and the convenience of operation generally will, it is submitted, enabl high-power work to be carried on for long periods with an ease an comfort not hitherto possible with a microscope of the type a present in use.

Plate IV shows the instrument in position for working at a angle, while in Plate V it is shown in the vertical and horizonta positions respectively.

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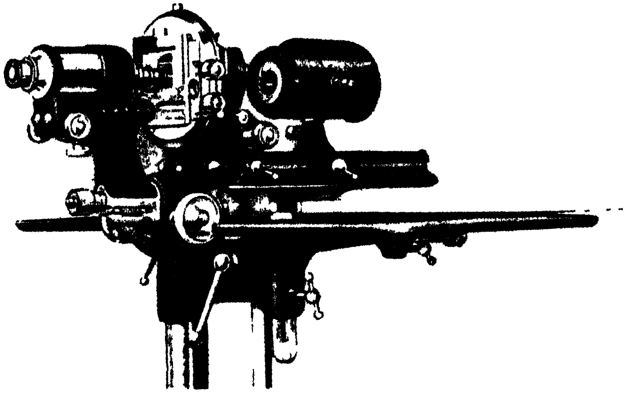

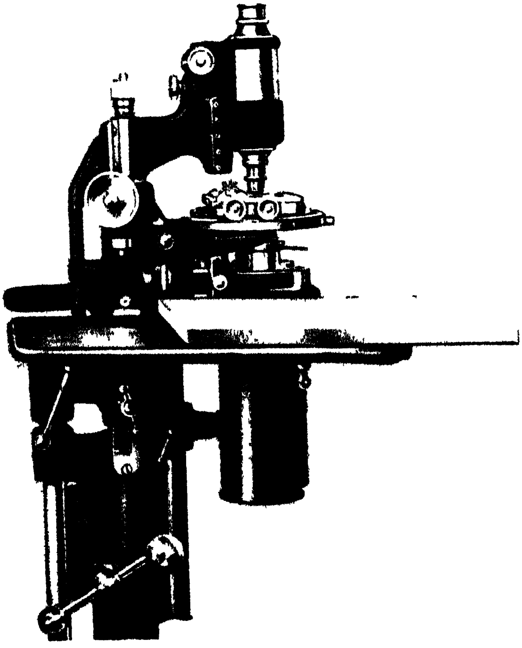

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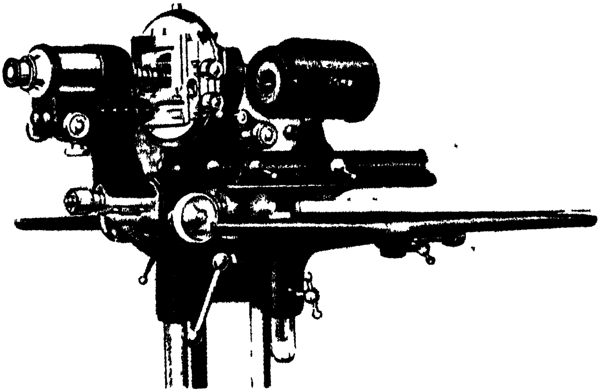

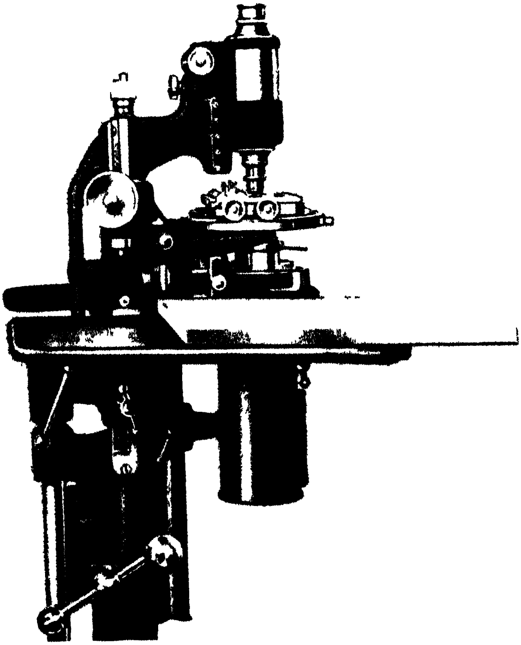

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V.—A NOTE ON AN IMPROVED METHOD OF PREPARATION OF WEIGERT'S ELASTIN STAIN.

By F. Haynes, M.A., Department of Physiology,
University of Oxford.

(*Read February* 17, 1926.)

The writer has for some time past found that Weigert's elastin stain, made up according to the following method, is more precise in its action, and less liable to deterioration, than that made up according to the original method.

A 1 p.c. aqueous solution of basic fuchsin is made, and 2 p.c. of phenol added. The mixture is brought to the boiling-point, preferably in a large porcelain capsule or enamel dish (on account of the frothing which occurs during the precipitation), and a 50 p.c. solution of ferric chloride is added to excess—i.e. until the fluid in the vessel is yellow, with a fine black precipitate. The mixture is boiled for 10 minutes to render the precipitate more granular, allowed to cool, and the precipitate filtered off by means of a Buchner suction filter flask and funnel. The precipitate is thoroughly washed on the filter with distilled water until the runnings are iron-free, and the precipitate dried in a hot-air or steam oven, and stored for use.

The powder keeps indefinitely. When required for use, 0·75 grm. is added to 100 cc. of 96 p.c. alcohol, to which has been added a few drops of concentrated hydrochloric acid. The mixture is boiled under a reflux condenser for 15 minutes. After cooling, filter, and add 2 p.c. of concentrated hydrochloric acid to the filtrate, which is then ready for use.

The stain keeps well for at least two months, after which the staining time requires to be lengthened.

If a reflux condenser be unobtainable, heat a sand bath, remove the flame, and place the flask containing the alcohol and powder in the hot sand until it has boiled for the requisite time.

The precipitate may be filtered off from the reaction mixture in an ordinary filter if desired, but, on account of the finely particulate nature of the precipitate, the filtration is slow and troublesome.

Phenol-fuchsin gives a darker stain to elastic fibres than resorcin-fuchsin, keeps better, and is cheaper. Mann ("Methods and Theory of Physiological Histology," p. 445) advocates the use of an excess of ferric chloride, but dissolves the water-logged precipitate in 96 p.c. alcohol without filtering. Weigert's stain is almost insoluble in water; therefore it is advisable to drive off as much water from the precipitate as possible. Solution of the powder in alcohol is facilitated by the addition of a few drops of hydrochloric acid to the alcohol. In the writer's hands the presence of traces of ferric chloride in the staining solution is not, as stated by Mann, an advantage, but rather the reverse.

OBITUARY.

CAMILLO GOLGI,

1843-1926.

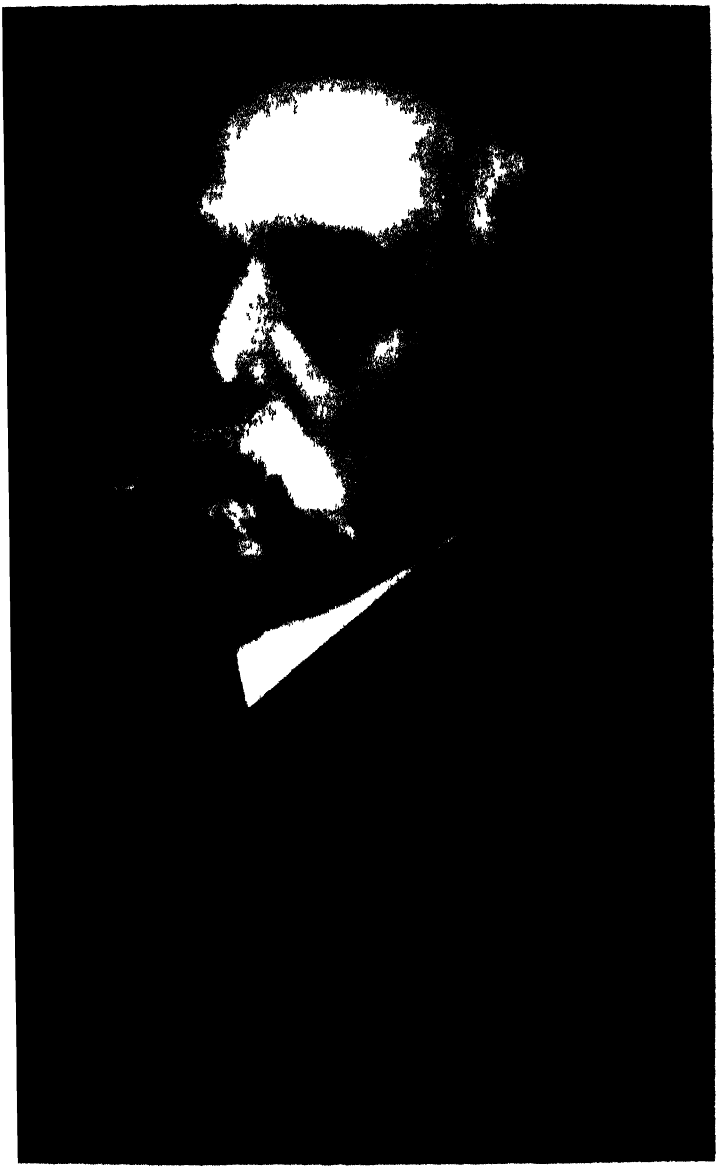
PROF. CAMILLO GOLGI, member of the Italian Senate for a number of years, Nobel Prizeman in 1906, died on January 21. Son of a medical practitioner, he was born in Corteno (Brescia) on July 1, 1843, and, following the family tradition, went to study medicine at the University of Pavia close by, where he took his degree in 1865, and was for some time a pupil and assistant of Lombroso and Mantegazza, who a few years previously had founded the Laboratory of Experimental Pathology. In spite of the scarcity of its means the new Institute soon became famous, particularly under the superintendence of G. Bizzozero, with whom Golgi started a friendship which was to end only with the premature death of the former in 1901.

However, the necessity of making a career for himself, and perhaps financial difficulties, compelled Golgi to leave Pavia for the Home for Incurables of Abbiategrasso, in the Province of Milan, where he went as chief resident physician. Abbiategrasso was in those days only a village, remote from any centre of scientific activity, and one can easily imagine with how many difficulties young Golgi had to struggle till 1875, when he returned to Pavia as Extraordinary Professor of Histology. Towards the end of that year he went as Professor of Anatomy to the University of Siena, to come back a few months afterwards to Pavia, where he again occupied the chair of Histology. In 1879 Golgi took over the superintendence of the Institute of Experimental Pathology and became Professor of General Pathology and Histology, a position which he occupied till 1918, the year of his retirement from active teaching.

It was in Abbiategrasso that Golgi wrote his early papers on the history of pellagra, the etiology of mental alienations, the structure and development of psammomata, the changes of the lymph-vessels of the brain, and the structure of the neuroglia, which even now can be consulted with profit. And it was in the Hospital there that he discovered his chromate of silver method, by means of which nerve-cells, with all their processes and the finest ramifications of the latter, can be seen singled out and intensely stained black against a transparent yellowish background. At a time when histological technique was in its infancy, and the structure of the central nervous system looked like an impenetrable mystery, Golgi's discovery revealed the existence of an unforeseen world. A first hint of the new method was given in his paper on the grey substance of the brain (1873). However, the so-called slow process was fully described only in 1875, and the bichromate and mercury chloride method in 1878. The rapid process was first published in his paper on the structure of medullated nerve-fibres (1880). All of them and the mixed process were again minutely described in the last chapter of his monumental work, "Sulla fina anatomia degli organi centrali del sistema nervoso," published between 1882 and 1885.

By means of Golgi's methods the microscopical anatomy and physiology of the central nervous system were placed on the sound foundation on which they at present rest. He had since 1873 observed the long- and short-axoned nerve-cells with which every medical and science student is now familiar, and the collaterals arising from the axon of the cells of the I type; and in 1874 he had already described the large nerve-cells of the granule layer of the cortex cerebelli which bear his name, and pointed out that the "granules" are in fact minute nerve-cells. In 1875 he had been able to give a first description of the structure of the olfactory bulb, and to show that both the olfactory fibres and the protoplasmic processes of the mitral cells arborize within the olfactory glomeruli. But it was only in his main work that he set forth definitely the results of his fundamental studies on the morphology and relations of nerve-cells, the central origin of nerves, the architecture of some cerebral convolutions, the structure of the cortex cerebelli and hippocampal region, with the addition of fresh observations on the morphology, connections with blood-vessels, and histogenesis of neuroglia cells.

Golgi's description of the diffuse network (*rete nervosa diffusa*) was the anatomical corollary of these investigations, and of those on the structure of the spinal cord (1880 and 1890). As he observed in various papers, and again in his lecture at Stockholm, his diffuse network consists essentially of the collaterals of the axis-cylinder of the long-axoned cells, the complicated arborizations of the axis-cylinder of the short-axoned cells, and the collaterals and arborizations of the axis-cylinder of the motor and sensory nerve-fibres which reach any given region of the nervous system from others. He always considered the diffuse network, not as a working hypothesis, but as a well-defined anatomical entity linking together the different parts and functions of the nervous system. He was, however, extremely keen on pointing



out that it is immaterial whether the thin filaments composing the network actually anastomose with one another or are simply superimposed to form thick interlacements. In other words, the continuity of the innumerable and non-insulated nerve-fibres which permeate the grey substance was in no way necessary to his conception of the united action of whole groups or layers of nerve-cells, or even entire regions of the central nervous system. For these reasons he persistently refuted the neurone theory, though based on the results of his methods, and could never agree to the individual action of nerve-cells postulated by this doctrine.

Mention can only be made of other discoveries, such as the sensory end-organs of tendons (1880), the exact course of uriniferous tubules (1889), and the secretory canaliculi of the oxyntic cells of the gastric glands, which Golgi succeeded in impregnating at the same time as Erik Muller (1893). The pericellular investment and the internal apparatus of nerve-cells were described in the same paper in 1898, and the neurofibrils of the superficial portions of nerve-cells in 1900. In 1908 he published his arsenious acid method for the demonstration of the internal apparatus, and, by showing (1909) that this cell-organ may in certain epithelia become shifted from its ordinary position, he anticipated the results of recent investigations regarding the important part that the apparatus probably plays in secretion.

Of Golgi's researches in the field of pathology, it will suffice to recall his observations on malaria (1885–1893). After Laveran's discovery, Golgi gave a masterly description of the parasites of the tertian and quartan fever and their non-sexual cycle of development By showing that the beginning of fever in malaria coincides with the sporulation phase, taking place at intervals definite for each species of the parasite, he led the way to the rational use of quinine in the struggle against this scourge of humanity.

In spite of his age, Golgi had preserved until a short time ago the extraordinary lucidity of his mind, and when the writer last saw him in January 1924 he was still taking part in the public life of his country and the many activities of the University of Pavia. Only a few days before his fatal illness he had dictated and signed a letter to the writer of this notice asking him to convey his warmest thanks to Professor W. Bulloch, who in December had successfully proposed that he should be made an Honorary Fellow of the Royal Society of Medicine. It was the last of a long series of honours which were bestowed upon him from every part of the world. It may be particularly interesting to the British reader to recall that he was elected an Honorary Fellow of this Society in 1895 and of the Royal Society of Tropical Medicine and Hygiene in 1907; he became also an Honorary Member of the Pathological

Society of Great Britain and Ireland in 1907, while he had been the recipient of the Honorary Degree of Sc.D. in the University of Cambridge in 1898.

His name had already become legendary among medical and science students; many of them will be surprised to hear that even a few weeks ago he was still among us. C. DA FANO.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY,

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.*

ZOOLOGY.

(*Under the direction of* DR. C. DA FANO)

A. VERTEBRATA.

a. Embryology, Evolution, Heredity, Reproduction, and Allied Subjects.

Influence of Centrifugalization on the Development of Segmented Eggs of Anurous Amphibians.—M. BAGINI ("Azione delle centrifugazione sullo sviluppo uova segmentate di anfibî anuri," *Arch. ital. di anat. e di embr*, 1925, **22**, 35–88, 2 text-figs. and 8 pls.). In contrast with the results obtained by Ch. Morgan the author's experiments show that eggs of anurous amphibians, if centrifuged when in the blastula phase, give rise to larvæ with considerable anomalies and even malformations. These are due to the forced shifting of blastomeres, which subsequently develop into tissues more or less normal in aspect, but abnormally situated. The formative capacity of each blastomere is not due to the position it occupies but to its biological properties. However, the same eggs become resistant to high-speed centrifugalization when the gastrula stage is overcome, particularly when the embryo is formed. Eggs centrifuged during the earliest segmentation phases invariably die out. C. D. F.

The Histogenesis of Cartilage and Bone in the Long Bones of the Embryonic Fowl.—H. B. FELL (*J. Morph. and Physiol.*, 1925, **40**, 417–59, 17 figs. on 4 pls.). The development and cytology of cartilage and bone in the limbs from the fifty-second hour of incubation to the first day after hatching are described. The chief points of interest arising from this study are: (1) Chondroblasts when liberated during cartilage resorption die and disintegrate. (2) All the long bones possess structures which, though not undergoing independent ossification, are homologous with the mammalian epiphyses. (3) Endochondral ossification occurs only in the epiphyses and ends of the diaphyses. (4) The marrow cavity contains multinucleated giant cells which appear to be formed by the fusion of degenerating cells. R. J. L.

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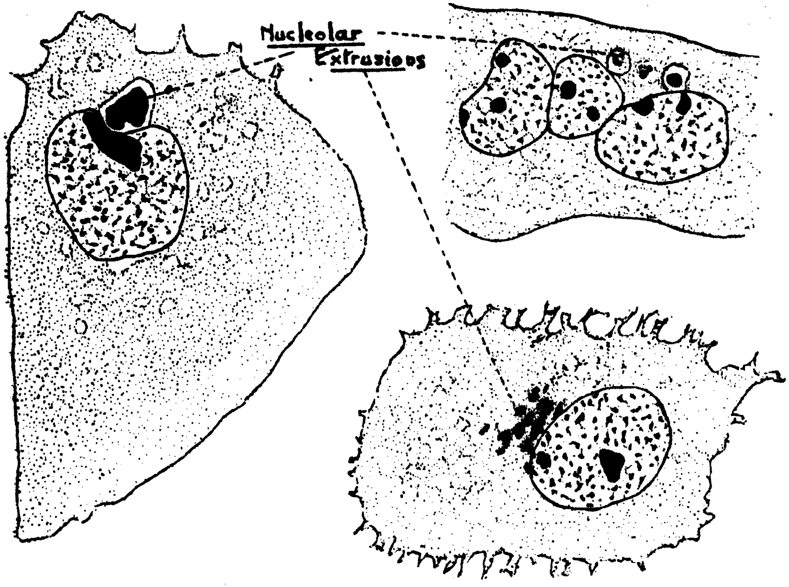
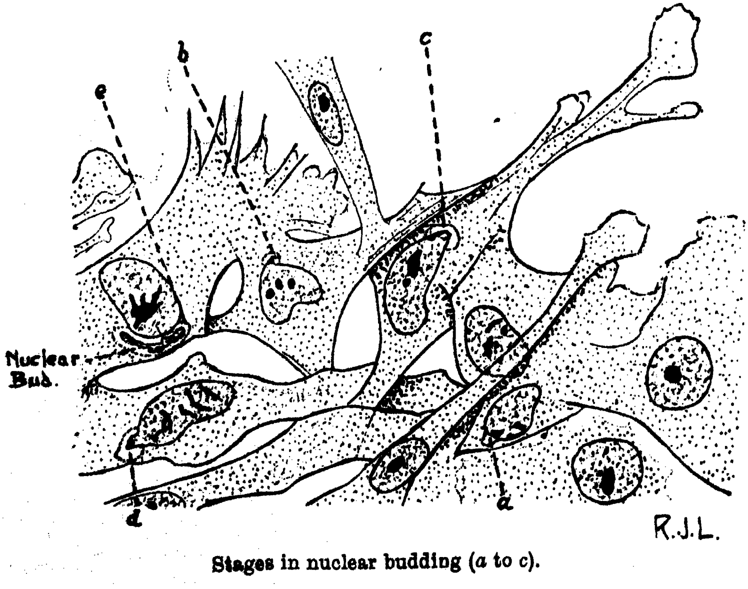
* The Society does not hold itself responsible for the views of the authors of the papers abstracted. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, etc., which are either new or have not been previously described in this country.

Nuclear Activity in Tissue Cultures.—R. J. LUDFORD (*London, Proc. R. Soc.*, 1925, **98**, B, 457–67, 6 text-figs.).



Various forms of nucleolar extrusion in cultures of fibroblasts from rat's kidney.



Stages in nuclear budding (*a* to c).

Origin of the Purkinje Fibres of the Heart of Mammals.—L. Stiénon ("Recherches sur l'origine du système Purkinien dans le cœur des mammifères," *Arch. biol.*, 1925, **35**, 89–115, 1 pl.). The Purkinje fibres of the heart of mammals (sheep, rabbit and man) arise exclusively from the trabecular system which, in the fœtal heart, has the same function as the Purkinje fibres and the auriculo-ventricular system have in the adult. After having given rise to these formations, the remains of the trabecular system fuse with the myocardium proper and contribute to its development, forming chiefly the papillary muscles and columnæ carneæ of the adult heart. C. D. F.

The Chievitz Organ of Man and some Mammals.—M. Bollea ("Sull' organo di Chievitz dell uomo e di alcuni mammiferi," *Arch. ital. di anat. e di embr.*, 1924, **21**, 464–86, 7 text-figs.). The Chievitz organ is an epithelial strand situated in the thickness of the lateral wall of the mouth parallel to the Stenson duct. Occasionally it is hollow and runs from a point situated a little dorsally to the opening of the Stenson duct to the ventral margin of the m. pterigoideus internus. It is found in man and many mammals during intra-uterine life and for some time after birth. It can be compared to the epithelial strands and nodules of the palatine raphe. The supposition that it may be a remnant of an endocrine gland has very little in its favour. C. D. F.

Cytoplasmic Growth Principles of Tissue Cells.—A. Fisher (*Arch. f. exper. Zellforsch.*, 1925, **1**, 375–7). Series of old and recent experiments on tissue cultures have led the author to assume that certain substances or principles controlling the functional activities of tissues circulate in the living protoplasm of organisms. These substances (desmones) would be unable to subsist outside the living cytoplasm, and would pass from cell to cell by means of their protoplasmic connecting bridges. In fact old cultures of fibroblasts, degenerating and dying in spite of the presence of embryonic trephones, can be rejuvenated by the addition of a minute amount of fresh leucocytes or of another (normally growing) culture of fibroblasts, which can likewise be used to prevent the death of degenerating sarcoma cells grown *in vitro*. C. D. F.

Development and Significance of the Endocrine Islets of the Pancreas in Sheep Embryos.—E. van Campenhout ("Etude sur le développement et la signification morphologique des ilots endocrines du pancréas chez l'embryon de mouton," *Arch. biol.*, 1925, **35**, 45–88, 6 text-figs. and 3 pls.). In sheep embryos the islets of the pancreas consist of epithelial cells derived from the primary pancreatic ducts and of ganglion cells derived from the sympathetic. These sympathico-insular complexes increase in size and persist for a time, but subsequently give place to true Langerhan's islets formed at the expense of the exocrine tissue. A few sympathico-insular complexes can, however, be observed even in the adult condition. C. D. F.

Development of the Nose in the Spermophile.—B. T. Burns ("The development of the nose in the spermophile, with particular reference to the part played by the primitive choane in the formation of the nasal cavity in mammals," *Anat. Rec.*, 1925, **31**, 27–42, 12 text-figs.). In its essential features the development of the nose in the spermophile does not differ from that of other mammals in which it has been described. The primitive nasal cavities develop as a pair of ingrowths from the region of the olfactory placodes. A. S. R.

Histogenesis of Sarcostyles.—C. COLLADO AQUIRRE ("Sobre el origen y evolution de las miofibrillas," *Bol. r. soc. espan. hist. nat.*, 1925, **25**, 380–403, 5 text-figs.). Sarcostyles appear to be a product of the transformation of the protoplasmic network of primary myoblasts. This process is at first limited to the cortical layer of the myoblast and then extends to its remaining or deep portions. There is no evidence in favour of the theory according to which the sarcostyles arise from a transformation and fusion of mitochondria. As a rule the first recognizable stripe or line is that of Dobie. C. D. F.

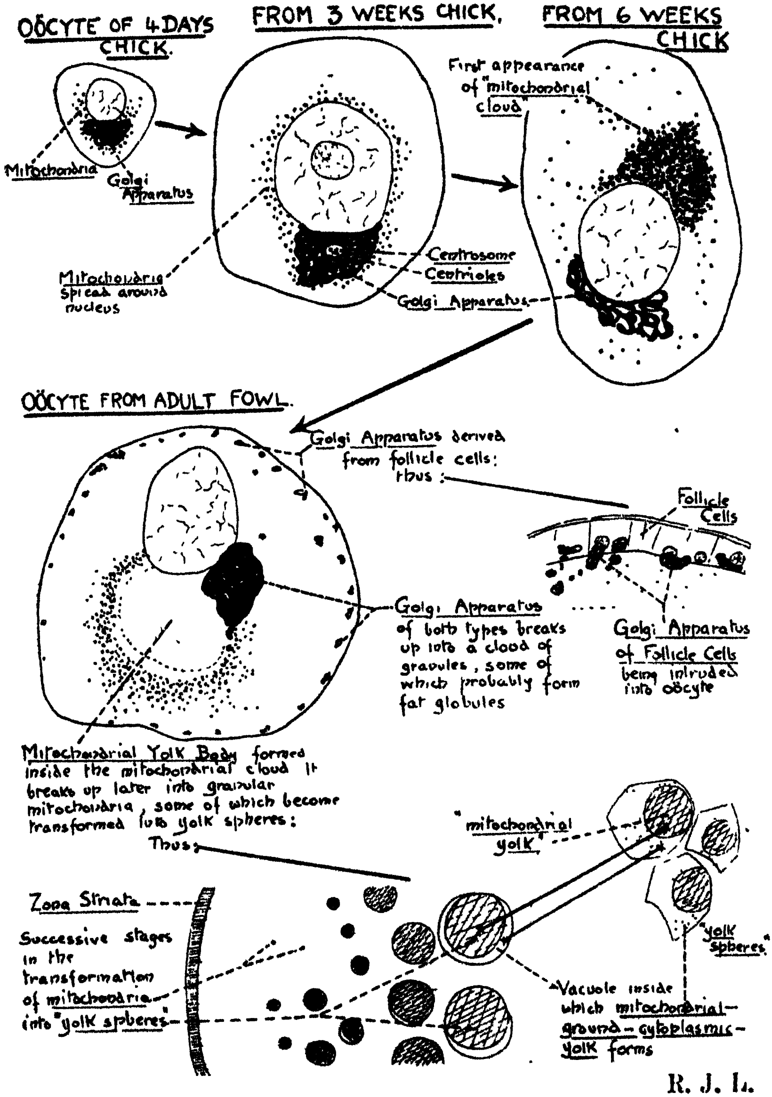
On the Descended Testes of Sex-intergrade Pigs.—J. R. BAKER (*Q. J. Microsc. Sci.*, 1925, **69**, 689–701, 8 text-figs.). The descended testes of four sex-intergrade pigs were studied histologically. The seminiferous tubules were usually quite degenerate, but some contained a few abnormal spermatozoa. It is suggested that the sex-chromosome equipment of sex-intergrades is abnormal. The interstitial cells were normal and functional. F. W. R. B.

The Sexual Cycle in the Female Mammal.— R. COURRIER ("Le cycle sexuel chez la femelle des mammifères. Etude de la phase folliculaire," *Arch. biol.*, 1924–5, **34**, 369–477, 5 pls.). In the adult female of mammals the generative organs and mammary gland undergo cyclic changes which are chronologically and intimately connected with the maturation of the Graafian follicles and the formation of the corpus luteum. During the former process or follicular stage, the mammary and uterine glands become hypertrophic. The oviduct enters a phase of intense secretion and the vaginal epithelium actively proliferates, These phenomena are considerably accentuated during the luteinic stage. They are very likely brought about by a substance (folliculine) which can be extracted from the liquor folliculi, and used for control experiments. C. D. F.

Formation of Archenteric and Segmentation Cavities of the Eggs of the Engystomatid Frog.—C. R. NARAYANARAO and B. S. RAMANNA (*Q. J. Microsc. Sci*, 1925, **69**, 731–44, 1 pl.). In the three genera Cacopus, Microphyla and Callula of Engystomatid frogs dealt with in this paper, the enteron arises firstly as a fusion of the dorsal and ventral archenteric slits, while in Rana and Bufo the archenteron is formed solely from the enlargement of the dorsal slit. The fusion of the primary mesenteron with the segmentation cavity anteriorly and with the secondary blastocoel posteriorly is noted. The blastoporal ring develops dorsal and ventral lips at about the same time in Engystomatid frogs. There are two distinct gastrular mouths leading into two separate slits whose enveloping movements to form the mesenteron are outwardly indicated by the convergence of the limbs of the two lips. The formation of the second blastocoelic chamber in the Engystomatid eggs is due to their need for increased provision of mechanica and metabolic devices for precocious developmental modifications.

A. S. R.

The Oogenesis of the Fowl (Gallus Bankiva).—F. W. R. Brambell (*London, Phil. Trans. R. Soc.*, 1925, Series B, 113–51, 6 pls. and 5 text-figs.).


OÖCYTE OF 4 DAYS CHICK.
FROM 3 WEEKS CHICK.
FROM 6 WEEKS CHICK
First appearance of "mitochondrial cloud"
Mitochondria
Golgi Apparatus
Mitochondria spread around nucleus
Centrosome
Centrioles
Golgi Apparatus
OÖCYTE FROM ADULT FOWL.
Golgi Apparatus derived from follicle cells: thus :
Follicle Cells
Golgi Apparatus of both types breaks up into a cloud of granules, some of which probably form fat globules
Golgi Apparatus of Follicle Cells being intruded into oöcyte
Mitochondrial Yolk Body formed inside the mitochondrial cloud it breaks up later into granular mitochondria, some of which become transformed into yolk spheres: Thus:
"mitochondrial yolk"
"yolk spheres"
Zona Striata
Successive stages in the transformation of mitochondria into "yolk spheres"
Vacuole inside which mitochondrial-ground-cytoplasmic-yolk forms

R. J. L.

Cultures in vitro of the Allantois.—W. F. Katzenstein ("Studien über die Allantois und ihre Kultur *in vitro*," *Arch. f. exper. Zellforsch.*, 1925, **1**, 173–92, 6 text-figs. and 2 pls.). Fragments of the allantois of chick embryos of the fourth day show in cultures *in vitro* a mesenchyme-growth which after two to three days gives place to an epithelial development, as seen at once in fragments of the allantois from the sixth day of incubation. The cut ends of the fragments show *in vitro* a tendency to draw near to one another, giving rise to roundish shapes; when mesenchyme cells occur at the edges, they become parallel to one another and form a lamellar bridge between the two ends; when epithelial cells occupy the edges of the fragments they grow, on the contrary, into a rather wide border. After a time a delimiting membrane is found between epithelium and mesenchyme, and in the plasma of the culture large cells with small nuclei which can be considered as mesothelial in nature. In the cultivated allantois blood islands appear, and a transformation of the mesenchyme cells into blood cells can be seen. An addition of embryo extracts to the medium has no influence on these growth phenomena, which are practically identical with those taking place under physiological conditions. C. D. F.

The Blastocoelic and Enteric Cavities in the Amphibia.—E. S. Goodrich (*Q. J. Microsc. Sci.*, 1925, **69**, 745–6, 3 text-figs.). The author discusses the significance of the fusion of the archenteric and blastocoelic cavities, and offers an interpretation to clear up the confusion that has arisen by the application of the term "segmentation cavity" to a space in the yolky endoderm of some anura, and on the assumption that it forms part of the blastocoel. The difficulty disappears if the cavity in question is considered to represent fluid yolk or liquid endoderm filling a space in temporary continuity with the true blastocoel. This endodermal or yolk cavity may then be compared to the small intercellular spaces described by Kerr in Lepidosiren, the larger spaces in the yolk of Hypogeosis (Brauer), and the subgeminal cavity of Reptilia.
A. S. R.

Action of X-Rays on Embryonic Development.—P. Ancel et P. Vintemberger ("Etude de l'action des rayons X sur le développement embryonnaire," *Arch. biol.*, 1925, **35**, 1–48, 1 pl.). X-rays do not accelerate the development of the egg of the hen or frog. Statements to the contrary by other authors are based either on observations wanting in precision or errors due to the insufficient account taken of individual variations. *X*-rays have a harmful effect on developing eggs even if employed in very small quantities. C. D. F.

The Age Order of Epiphyseal Union in the Long Bones of the Albino Rat.—A. B. Dawson (*Anat. Rec.*, 1925, **31**, 1–17, 12 figs. on 3 pls.). In the albino male rat the sequence of union of the various epiphyses of the long bones is definite and constant. The epiphyses may be divided into two groups according to the age period in which they unite to their respective shafts—viz. (1) from the first month to the end of the fifth month, and (2) from the thirtieth month to senility. A. S. R.

Formation of Germ-cells.—G. T. HARGITT ("The formation of the sex glands and germ-cells of mammals. I. The origin of the germ-cells in the albino rat," *J. Morph. and Physiol.*, 1925, **40**, 517–58, 27 figs. on 5 pls.). Germ-cells are first found in the peritoneum which is beginning to thicken to form the genital ridge, and they continue to form from the peritoneum as the gonad develops. Early segregation of the germ-cells and migration through a germ track into the gonads does not occur, but only from the peritoneum of the genital region are germ-cells produced. It is concluded that the argument for the specific character of the germ-cells and their continuity from the egg is based largely upon assumption and not upon substantial observation; germ-cell origin is a question of cellular differentiation, not of early ontogenetic segregation.
A. S. P.

β. Cytology and Histology.

Peroxydase and Oxybenzidinophil Granules.—M. PRENANT ("Granulations a peroxydases et granulations oxybenzidinophiles." *Bull. hist. appl. à la physiol. et à la path.*, 1925, **2**, 329–42). The cytoplasmic peroxydases observed in animal cells by the Madelung reaction (benzidine and H_2O_2) are localized in protoplasmic granules or other formed materials. As far as it has been possible to ascertain they never occur in a diffused state, and should in principle be considered as different from the oxybenzidinophil granules of Hollande. These appear in certain cells by precipitating benzidine blue in a hydro-alcoholic medium without the intervention of H_2O_2. One should, however, keep in mind that while in a certain number of cases the intracytoplasmic distribution of the peroxydase and oxybenzidinophil granules is different, in others the Madelung and Hollande methods lead to identical results.
C. D. F.

Histological Studies on the Gonads of the Fowl. –H. B. FELL ("The Relationship of the Luteal Cells of the Ovary of the Fowl to the Tissue occupying the Atretic and discharged Follicles, and the Question of the Homology of the latter Tissue and the Mammalian Corpus Luteum," *Q. J. Microsc. Sci.*, 1925, **69**, 591–609, 1 pl. and 4 text-figs.). The vacuolated tissue which invades the cavities of atretic and discharged follicles is derived from the membrana granulosa and the connective-tissue cells of the theca interna by fatty degeneration and follicular contraction. These cells are easily distinguished cytologically from the "luteal" cells. The pigment found in atretic and discharged follicles is the blood-pigment, hæmosiderin. The author finds no significant point of resemblance between the corpus luteum of mammals and the fatty tissue in the atretic and discharged follicles of the fowl. A true corpus luteum does not occur in the ovary of the fowl.
F. W. R. B.

Conservation and Loss of the Independence of Tissue Cells.—G. LEVI ("Conservazione e perdita dell' indipendenza delle cellule dei tessuti," *Arch. f. exper. Zellforsch.*, 1925, **1**, 1–57, 26 text-figs. and 1 pl.). In the tissues of the embryo chick syncitia characterized by a complete loss of the biological individuality of the composing cells do not occur. Even the tissues in which the connection between cell and cell are most intimate (myocardium, mesenchyme) show in cultures *in vitro* a protoplasmic activity leading to the migration of single cells into the clot. Subsequently the cells may either adhere to or even unite with one another and then again re-acquire their independence. Syncitia should, therefore, be considered as consisting of plasmatic masses or areas which are biologically deliminated by the sphere of influence of their nuclei, and though intimately united they still possess, potentially, the capacity of separating from one another. C. D. F.

Mitochondria and Secretion Granules of Neuroglia Cells.—P. Del Río-Hortega ("Condrioma y granulaciones específicas de las células neuroglicas," *Bol. r. soc. espan. hist. nat.*, 1925, **25**, 34–55, 11 figs. on 5 pls.). In all neuroglia cells mitochondria and secretion granules (gliosomes) can be shown by different methods, two of which are now proposed by the author. Mitochondria and gliosomes appear to be related to one another, but it is not clear in what degree. In some cases a distinction between mitochondria and secretory granules is very easy, in others almost impossible. Nageotte was the first to consider neuroglia as an interstitial gland attached to the central nervous system; but since 1910, when this suggestion was put forward, no observation has been made definitely showing the physiological purposes of the secretory activity of neuroglia cells, and one can only surmise that it is in some manner connected with the metabolism of nerve cells and nerve fibres. C. D. F.

On Perivascular Neuroglia.—P. del Río-Hortega ("Algunas observaciones acerca de la neuroglia perivascular," *Bol. r. soc. espan. hist. nat.*, 1925, **25**, 184–204, 9 text-figs.). Neuroglia cells may be attached to the adventitia of small arteries and precapillaries as well as to the wall of capillaries, not by the perivascular end-plates of their processes, but by means of their cell body. This form of connection between neuroglia cells and blood vessels is very intimate, and more frequent than hitherto suspected. In consideration of the old investigations of Andriezen on the subject, the cells in question should be termed perivascular neuroglia cells of Andriezen. They are characterized by their well-developed and flattened cytoplasm, and by the great number of their processes, which may be either entirely protoplasmic or protoplasmic and fibrous. Their situation is in favour of their probable trophic function, but the author cannot agree with Andriezen as regards their supposed rôle of safeguarding nerve elements from the shock of arterial blood waves, because they do not form a continuous investment, and the attenuation of the arterial pulse is effectuated by the adventitia which, though very much reduced, is found even round the smallest precapillaries. C. D. F.

Oligodendroglia and its Relation to Classical Neuroglia.—W. Penfield (*Bol. r. soc. espan. hist. nat.*, 1925, **25**, 218–43, 9 text-figs.). The cells separated by Cajal from neuroglia under the name "third element" consist of oligodendroglia and microglia (Del Río-

Hortega). The term "mesoglia cells" used by F. Robertson should be dropped, as these cells do not seem to have a mesodermal origin. Oligodendroglia cells are particularly numerous in the white matter, where they form with their vine-like processes an incomplete investment for the myelin sheaths; in the grey matter they are chiefly arranged about neurones, forming, with the microglia cells, the perineuronal satellites. Oligodendroglia cells are similar to those of the classical neuroglia, though smaller in size and with only a few processes; these never develop fibres, and have no vascular foot-plates. Transitional forms between oligodendroglia and neuroglia are seen in certain mammals a few days old. Functionally the relation to nerve cells and medullary sheaths of oligodendroglia cells corresponds with the relation of subcapsular cells to neurones of spinal ganglia, and that of the Schwann cells to peripheral nerves. Oligodendroglia cells appear in the central nervous system at the time of maximum myelinization, containing large granules, which suggest a secretory function. C. D. F.

The Chromaffin Cells of the Digestive Tract.—H. KULL ("Die chromaffinen Zellen des Verdauungstraktus," *Zeitschr. f. mikr. anat. Forsch.*, 1925, **2**, 163–200, 2 pls.). The so-called acidophil and chromaffin cells of the intestinal epithelium are only different secretory phases of one kind of cells, viz. the enterochromaffin cells. The youngest stages have only acidophil granules, which subsequently increase in number, and acquire the characteristic affinity for chromic acid. The enterochromaffin cells are very frequently situated close to capillaries, into the lumen of which they probably shed their secretion. In man they occur not only in the intestine and Brunner's glands, but also in the pyloric stomach and in the last portion of the pancreatic duct. Observations on chick embryos show that the enterochromaffin cells migrate during development from the connective tissue into the intestinal epithelium. They contain mitochondria, part of which are situated within the Golgi apparatus, where, under its influence, they become transformed into secretion granules. In the guineapig the enterochromaffin cells never pass through the acidophil phase, and they are also found in the gastric glands, œsophagus and pancreatic ducts. Enterochromaffin cells likewise occur in birds, reptiles, amphibians and fishes; in these last, however, they are very rare, and their granules are acidophil throughout life. C. D. F.

Intracellular Situation of Nerve-endings in Epithelia.— J. BOEKE ("Die intrazelluläre Lage der Nervenedigungen im Epithelgewebe und ihre Beziehungen zum Zellkern," *Zeitschr. f. mikr. anat. Forsch.*, 1925, **2**, 391–428, 26 text-figs.). In the cornea of the frog and of birds in general the nerve fibres of the so-called subepithelial plexus are in fact situated in the cytoplasm of the cells of the deepest (basal) epithelium layer. Finer fibres arise from the basal ones and become distributed to the cells of the other layers, terminating in minute enlargements which are situated intracellularly and frequently quite close to the nuclei. A somewhat similar arrangement is observed in the mole's snout and hedgehog's tongue, particularly where taste-buds occur, the terminal and finely reticular end-bulbs being very intimately related to the nuclei. In the Grandry corpuscles the terminal nerve arborizations form an inseparable portion of the cytoplasm of the tactile cells and completely envelop their nuclei. C. D. F.

Systems of Vacuoles and Golgi's Apparatus in Vertebrata.—M. AVEL ("Vacuome et appareil des Golgi chez les vertébrés," *C.-R. Acad. sci.*, 1925, **180**, 959–61). According to the author the occurrence of a system of vacuoles in all cells of vertebrates, as described by Parat and Painlevé, has not as yet been sufficiently substantiated by appropriate observations; and the vacuoles, whether pre-existing or not, which can be shown *intra vitam* either by neutral red or similar staining substances, differ entirely from the Golgi apparatus. C. D. F.

Studies on Sarcoma Cells in vitro.—A. FISCHER ("Studies on Sarcoma Cells *in vitro*. I. Relation to fibroblasts. II. Relation to various Tissues. III. On the Factors causing Natural Resistance," *Arch. f. exper. Zellforsch.*, 1925, **1**, 108–14, 1 text-fig., 355–60, and 361–68). I. An old strain of fibroblasts cultivated side by side with an old strain of Rous's sarcoma cells *in vitro* is not able to prevent the growth of the sarcoma cells, even when the conditions are most favourable for the development of the fibroblasts. The sarcoma cells do not develop in plasma from old animals, but live and multiply indefinitely in homologous plasma from young ones. The sarcoma cells are amœboid and similar to the large mononuclear leucocytes of the circulating blood; under conditions, which are not as yet fully understood, they may become transformed into benign tissue-forming cells. (II) The addition of fragments of spleen, thyroid or thymus to cultures of the Rous sarcoma greatly favours its development; autoclaved muscle has an unfavourable influence on the same cultures, while liver abruptly inhibits their growth, occasionally giving rise to an abundant development of fibroblasts. (III) Neither the plasma, nor living tissues from a fowl refractory to the inoculation of the Rous sarcoma, has any inhibitory effect on the growth of the sarcoma cells *in vitro*. C. D. F.

γ. General.

Morphology of Striped Muscles in Chloroform Contraction.—J. NAGEOTTE ("Sur la morphologie du muscle strié en état de contracture chloroformique, chez la grenouille," *C.-R. Acad. sci.*, 1925, **180**, 1963–6). A frog's striped muscle contracts to about 80 p.c. of its previous length if exposed to chloroform vapours in a damp chamber for about forty-five minutes. This contraction is reversible only in its initial phase when the muscle is still electrically excitable. The excitability soon ceases, but the muscle continues to contract. Histologically this form of contraction is characterized by the appearance of irregular transverse bands which are seen sooner than in the case of the contraction due to a tetanizing current. In the last phases of the process the bands grow in size and end by almost touching one another. While contraction progresses the muscular fluid plasma (myosine) is expelled from the sarcostyles, but, instead of accumulating between the bands as in the faradic contraction, it forms a thin opalescent clot on the surface of the muscle. C. D. F.

Studies on Lymphocytes.—H. E. Jordan and C. C. Speidel ("Further observations upon the Hemopoietic Effects of Splenectomy in Frogs," *J. Morph. and Physiol.*, 1925, **40**, 461–77, 4 text-figs.). Total splenectomy in the frog means practically complete extirpation of the erythropoietic apparatus. It may be followed by stimulation of erythropoiesis in the kidney (35–46 p.c.), in the fat bodies (5 p.c.), lymphocytopoiesis (8 p.c.), or in the bone marrow (11 p.c.). There may be formed a new spleen (8 p.c.), or there may be no perceptible erythropoietic stimulation (24 p.c.), which results in death. Partial splenectomy leads to spleen regeneration. Total splenectomy experiments indicate that the chief function of the spleen in the frog is concerned with its lymphocyte content, and in the transformation of lymphocytes into erythrocytes. R. J. L.

Heart Cultures.—A. A. Krontowki ("Pathologisch-physiologische Beobachtungen uber Herzexplantate," *Arch. f. exper. Zellforsch.*, 1925, **1**, 58–65, 1 text-fig.). The rythmic activity of minute fragments of heart muscle cultivated *in vitro* can, without any great difficulty, be recorded on a revolving drum and thus be studied in all its details. By means of various examples the author shows how in this way many physiological and pathological phenomena of the heart activity are investigated independently of any external or nerve influence.

C. D. F.

Length of Testis Tubules.—K. F. Bascom and H. L. Osterud ("Quantitative studies on the testicle. II. Pattern and total tubule length in the testicles of certain common mammals," *Anat. Rec.*, 1925, **31**, 159–70). A quantitative method is described for determining the proportions of tubules and interstitial tissue. Testes from most of the common mammals were studied. The diameter of the tubules varied from 0·1834 mm. in the case of man to 0·2654 mm. in the case of the albino rat. The total tubule length showed enormous variation, the extremes being 1·67 metres (albino mouse) and 6312 metres (boar). In the larger mammals the increase in the area of germinal epithelium is thus brought about by increased length of the tubules rather than by increased circumference. In spite of this the total length of tubules relative to body-weight is greater in the small mammals such as the rat and mouse. A. S. P.

Structure of Otoliths by Dark-ground Illumination.—G. Tenaglia ("La struttura degli otoliti osservati a fresco in campo oscuro," *Atti Soc. lomb. sc. med. e biol.*, 1925, **14**, 186–94). The large otolith of amphibia and reptiles consists of a mass of minute crystals of calcium carbonate embedded in an almost fluid substance delimited by an extremely delicate membrane. In mammals the otolith is lamellar in shape and the crystals are held together by a somewhat thicker material; in birds the otolith is likewise lamellar and provided with a very thin membrane, but among the larger crystals many very minute ones are found which prevent one from detecting the presence of an amorphous material similar to that observed in mammals. The form of the otolith is influenced by the consistency of the amorphous material. When this is semi-solid, the otolith may assume a definite shape; but when it is fluid, the otolith remains suspended in the endolymph as a drop of a liquid immersed in another with which it cannot mix. C. D. F.

On Tissue Cultures of the Placenta.—V. PLJEŠAKOV (*J. Exper. Zool.*, 1925, **42**, 315–32, 3 pls.). The trophoblastic syncytium, owing to its highly specialized character, seems unable to remain alive *in vitro*. The cellular layer, however, displays great activity. Its elements, through losing the capacity of producing anew a typical syncytium, become transformed into multinucleated amœboid giant cells which migrate from the inplant into the nutritive medium. R. J. L.

Relation of Nerves to Degeneration and Regeneration of Gustatory Papillæ.—R. M. MAY ("Rapport des nerfs avec la dégénérescence et la régénération des papilles gustatives," *C.-R. Acad. sci.*, 1925, **180**, 547–9) Experiments were made on *Amiurus nebulosus* because in this fish the gustatory papillæ are concentrated on the barbels. It was noticed that, after section of the nerve filament at the base of some hairlets, its distal portion degenerated at the same time as the corresponding gustatory cells. Regeneration took place from the central stump and led to the transformation of some ordinary epithelial cells into new gustatory cells. These observations are in favour of Olmsted's theory, according to which a substance of the nature of a hormone continuously passes from the nerve fibres into the gustatory cells and activates their specific function. This ceases when the hormone supply is stopped, but it is taken over by other (epithelial) cells when the regenerating axis-cylinders reach them. C. D. F.

The Effect of Vasectomy on Swine.—B. L. WARWICK (*Anat. Rec.*, 1925, **31**, 19–22). The operations were performed by ligation of each vas deferens and removal of a section about ½ in. in length. The testes were removed from 125–398 days later. Live spermatozoa were observed and the histological picture appeared normal. It is concluded that in the case of animals having closed inguinal canals, as in swine, vasectomy does not of itself cause degeneration of the seminiferous tubules. A. S. P.

The Submaxillary Gland of the Cat.—K. TAKAGI ("Untersuchungen über die Unterkieferdrüse der Katze mit besonderer Berucksichtigung des Chondrioms," *Zeitschr. f. mikr. anat. Forsch.*, 1925, **2**, 254–323, 35 text-figs. and 18 figs. on 2 pls.). The lumen of the salivary ducts of the cat's submaxillary becomes very narrow under the influence of pilocarpin, but is wider during normal activity, and widest after faradization of the chorda tympani. The ducts are never entirely empty, and their content may appear either as a filamentous-frothy secretion giving a positive mucin reaction, or as a strongly eosinophil mass, or as granules which stain with iron-hæmatoxylin, and probably arise from the epithelium cells. These increase in size as the lumen of the ducts grows in width, and contain a granular material which during activity is extruded either fluidified (normally) or unaltered (faradization). The basal striation is due to chondrioconts, which by and by become transformed into secretory granules, and the more so the stronger the gland stimulation. Vacuoles occur only on artificial stimuli, which also cause a diminution in the volume and chromatin content of the nucleus. The acini and acinus-cells of the submaxillary are large when at rest, but become smaller during activity when the alveolar lumina correspondingly increase in width. The cells are filled with mucigen granules which subsequently grow in size and are extruded. New mucigen granules form in the apex of the cells after cessation of the stimulus. The chondrioconts of the alveolar cells behave like those of the epithelium of the ducts. The size of the crescents varies in different functional conditions, becoming particularly small in fasting animals and under the influence of atropine, when they contain granules larger than those of the alveolar cells. These granules, however, become smaller and fewer in animals which are fed, and after slight faradization, but increase in number after pilocarpin. Vacuoles are always present in the crescents and contain an amphitrop material, viz. staining slightly also with mucicarmin. The nature of the secretion of the crescent is nevertheless uncertain, because it cannot be identified either with mucigen or with a serous product like that of the parotid cells. The chondrioconts of the crescents are thicker and shorter than those of the alveolar cells, and their number is in inverse ratio to that of the secretory granules. C. D. F.

Contributions to the Development of the Skull in Sturgeons.—G. R. DE BEER (*Q. J. Microsc. Sci.*, 1925, **69**, 671–87, 20 text-figs.). The ten and a half-day *Acipense stellata* has a process the relations of which suggest that it is a basitrabecular process and may be a vestige of the basal articulation of the palato quadrate. The so-called profundus is a ramus ophthalmicus superficialis trigeminis, the profundus being absent. A. S. R.

Maximal Contraction following the Freezing of a Striped Muscle.—J. NAGEOTTE (“Sur la contraction extrême consecutive à la congelation du muscle strié chez la grenouille,” *C.-R. Acad. sci.*, 1925, **180**, 954–7). If a frog's sartorius muscle is frozen and then allowed to thaw, it first reacquires its normal aspect and then slowly contracts to about one-quarter of its previous length. This form of contraction is greater than that due to faradization, and is histologically characterized by the shortening of certain segments of the sarcostyles, which to all appearances contract first and pour their fluid content (myosine) into neighbouring portions of the same sarcostyles. The contracted segments can be seen separating from one another if, immediately after freezing, the muscle is cut into sections and these are collected in physiological salt solution. This is due, not to the dissolution of a cementing substance as hitherto supposed, but to the above phenomenon taking place suddenly in thin sections. If the segments are examined microscopically one can see that they consist of entirely contracted portions of small groups of sarcostyles. On the other hand, if during thawing the muscle is prevented from contracting and is then fixed and cut, the sections exhibit a complete disorganization of the contractile material not seen when the muscle is cut after freezing and the sections are collected in physiological salt solution. This shows that during freezing a corrosive substance is produced which, on thawing, disorganizes the contractile material unless it is washed away by physiological salt solution. In fact the sarcostyles exhibit a normal striation even after complete freezing if the muscle is fixed in alcohol at −15° C. C. D. F.

The Oily Drops of the Egg of Teleosts.—G. BRUNELLI ("Sul significato delle goccie oleose nell' uovo dei teleosti e sulla localizzazione delle ossidasi," *Atti. d. r. Accad. Lincei* (*Rend.*), 1925, **1** (VI S), 592–4.) The oily drops found in the egg and other situations of teleosts give a positive oxydase reaction when treated with napthol and dimethylparaphenilendiamin. According to the author this shows that the drops have a definite respiratory function. C. D. F.

Cultures of Adult Tissues in Homologous and Heterologous Medium.—S. KIAER (*Arch. f. exper. Zellforsch.*, 1925, **1**, 115–21, 1 text-fig.). Fibroblasts from embryo and adult ducks can be cultivated in chick embryonic extracts. Growth is genuine. There appears to be no difference in growth energy between fibroblasts from embryo ducks or chicks and fibroblasts from adult ducks or chicken. Cells of human sarcomata also grow in chicken embryonic extract. The embryonic cell does not, as supposed, possess any special growth energy, the multiplication both of embryonic and adult cells being influenced by the medium in which they live. C. D. F.

Cell Connections in Tissue Cultures.—H. LASER ("Über Zellverbindungen *in vitro* als Vorbedingung für Zellvachstum," *Arch. f. exper. Zellforsch.*, 1925, **1**, 125–9, 1 text-fig.). The reticulum cells of the spleen grow and multiply *in vitro* only if their processes succeed in uniting with one another. These connections are indispensable for the passage from cell to cell of metabolic products without which the cells apparently cannot live. C. F. F.

Reversible Gellification of Living Cells.—A. VAN HERWERDEN ("Reversible Gelbildung in Epithelzellen der Froschlarve und ihre Anwendung zur Prufung auf Permeabilitätsunderschiede in der lebenden Zelle," *Arch. f. exper. Zellforsch.*, 1925, **1**, 145–59). 0 1 p.c. acetic acid stops the Brownian movement of leucocytes migrated into the human saliva, and imparts a gelatinous consistency to the slightly viscous protoplasm of sporangiophores of *Onycomyces nitens* cut in distilled water. These phenomena are reversible if the action of the acid medium is stopped in time. The reversible gellification can be used for the study of changes in the permeability of the protoplasm of living cells. For instance, the epithelial cells of the tail of tadpoles show an increased permeability to acid solutions after exposure to radium radiations insufficient to alter their vitality. C. D. F.

A Biological Method of Measuring, using Leucocytes as Indicator.—S. KIAER (*Arch. f. exper. Zellforsch.*, 1925, **1**, 289–94, 10 text-figs.

and 1 pl.). According to the author the variations in width of the zone of growth in cultures of leucocytes prepared as suggested by Carrel can be used to measure the changes taking place in media employed for tissue cultures. For instance, the zone of growth of cultures of normal leucocytes is smaller than usual when plasma either from old chickens or from fowls infected with the Rous sarcoma is used, but the growth ring is larger if the plasma is obtained either from young chicks or from tuberculous fowls. C. D. F.

On Trephones—B. A. Schazillo ("Zür Physiologie und Pathologie der Trephone," *Arch. f. exper. Zellforsch.*, 1925, **1**, 160–9). Trephones are found in a purer condition in leucocyte extracts obtained from peritoneal exudations than in embryo extracts. As they have a nutritive function, they increase assimilation on the part of the cells and favour regenerative processes. When added to cultures *in vitro* from the heart of cold-blooded animals they increase the working capacity of the muscle cells. Endocrine products (thyreoglandol and testiglandol) favour disassimilative processes in cells cultivated *in vitro*, while adrenalin and thymoglandol stimulate their growth. The beneficial influence of thymus extracts appears due to the presence of trephones derived from the lymphoid elements of this organ. C. D. F.

Tissue Cultures in Heterologous Plasma.—N. G. Chlopin ("Studien uber Gewebskulturen in artfremden Blutplasma. I. Allgemeines. II. Das Bindegewebe der Wirbeltiere," *Zeitschr. mikr. anat. Forsch.*, 1925, **2**, 324–65, 13 text-figs. and 1 pl.). The connective tissue and certain epithelia of cyclostomes, bony fishes, urodele and anurous amphibians and reptiles can be kept alive and growing for at least one month in diluted rabbit's plasma. The lymphocytes, reticulum cells and desmocytes (fibroblasts) show *in vitro* certain characteristics which are proper to each cell group, no matter whether cultivated from one or the other of these vertebrates. In spite of their different aspect the lymphocytes and reticulum cells exhibit in cultures the properties which characterize the embryonic mesenchyme-cells, and each type may become transformed into the other under suitable conditions. The desmocytes are the ultimate and presumably irreversible product of a series of transformations of certain types of connective tissue cells (reticulum cells, lymphocytes); the intermediate phases are found among the permanent elements of the fully developed connective tissue of vertebrates, particularly of the lower classes. Hence the general conclusion that the connective tissue of all vertebrates is built up of elements morphologically and functionally alike.

C. D. F.

Tissue Cultures in Heterologous Plasma. III. and IV. Histogenesis and Intra-vitam Staining of Cells Cultivated from the Hæmatopoietic Organs of the Axolotl.—N. G. and A. L. Chlopin ("Studien über Gewebskulturen in artfremden Blutplasma. III. Die Histogenese der Zellformen in den Explanaten der blutbildenden

Organe des Axolotls. IV. Ein Beitrag zur Vitalfärbung explantierter Zellelemente," *Arch. exper. Zellforsch.*, 1925, **1**, 193–250, 4 text-figs. and 2 pls.). In tissue cultures of the hæmatopoietic organs of the Axolotl the reticulum cells and lymphocytes appear closely related to one another, and can be considered as equipotential cellular materials capable of giving rise to the special cells both of the blood and connective tissue. The so-called polyblasts and wandering cells of inflammatory tissues are homologous with the reticulum cells and their derivatives. The phagocytes and macrophages, which *in vitro* store particles of dyes used for *intra-vitam* staining, are only particularly active varieties of cells derived from the same materials. The melanophores are histogenetically related to the reticulum cells, while the desmocytes (fibroblasts) are irreversible derivatives of the same cells. The reticulum cells assume *in vitro* a hæmatopoietic function, during which erythroblasts and myelocytes are seen actively dividing. By means of slight modifications of *intra-vitam* staining methods three kinds of endocytoplasmic formations are shown in cells cultivated *in vitro* : (*a*) a granular material, chiefly in macrophages; (*b*) mitochondrial rods in desmocytes; (*c*) fragments of changing size and shape arranged like the Golgi apparatus in liver cells. C. D. F.

Degeneration and Regeneration in the Sympathetic Nervous System.—B. I. LAWRENTJEW ("Über die Erscheinungen der Degeneration und Regeneration im sympathischen Nervensystem," *Zeitschr. mikr. anat. Forsch.*, 1925, **2**, 201–23, 17 text-figs.). After section of pre-ganglionic fibres the portions of their peripheral stumps which are situated within the corresponding sympathetic ganglia entirely degenerate within five to six days, the degeneration extending to the pericellular (pre-ganglionic) endings. The changes shown by the degenerating fibres are similar to those seen under similar conditions in motor and sensory nerve fibres. This applies also to the degeneration of post-ganglionic fibres. Regeneration proceeds from the central stumps of the cut pre- and post-ganglionic fibres, and is already quite plain by the fourth day. The regenerating axons of the pre-ganglionic fibres gradually give rise to new pericellular endings. At the beginning of regeneration the neurofibrils of the ganglion cells involved assume a concentrical arrangement in the ventral portions of the cell body and cone of origin of the axon. During regeneration of post-ganglionic fibres all the processes of some of the corresponding cells show interesting phenomena of growth. C. D. F.

B. INVERTEBRATA.

General.

Mitochondria and Sperm-Tail Formation, with Particular Reference to Moths, Scorpions, and Centipedes.—V. NATH (*Q. J.*

Microsc. Sci., 1925, **69**, 643–59, 3 text-figs.). This paper contains a useful summary of the part played by mitochondria in sperm-tail formation, and the following original observations. In *Oporabia*, *Smerinthus* and *Pieris* the mitochondrial "nebenkern" does not directly form the tail-sheath, but undergoes a progressive dwindling and ultimately disappears. The sheath-forming substance arises as a new substance in the chromophobic cavity round the "nebenkern." The structure of the Lepidopteran mitochondrial "nebenkern" is alveolar or plate-work and not a spireme. In the centipedes (*Lithobius forticatus*) the mitochondria form the tail-sheath directly. R. J. L.

On Biophotogenesis.—V. PUNTONI ("Lo stato attuale della teoria microbica della biofotogenesi," *Riv. biol.*, 1925, **7**, 150–7.) The presence of phosphorescent bacteria (vibrios) has been ascertained only in the case of Sepiola, the photogenous organs of which are open. In the luminous organs of cephalopods living at great sea depths granules and rods are found, the microbic nature of which is rather doubtful.
C. D. F.

Mollusca.

γ. Gastropoda.

Anatomy of Clausiliidæ.—P. HESSE (*Proc. Malac. Soc.*, 1925, **16**, 154–62, 19 text-figs.). In hitherto unpublished papers of the late Mr. Wiegmann, the author finds many details of the anatomy of Clausiliids not yet examined by Wagner or others; the present paper deals with six of these. Their clausilia, genitalia, maxillæ and radulæ are described. The chief variations from already known forms are in the penis and epiphallus, and in the spermatheca and its duct and the diverticulum. Most of Wiegmann's material was in a dried condition. E. W. B.

The Radula of Coxia Anc.—A. J. PEILE (*Proc. Malac. Soc.*, 1926, **16**, 194, 1 text-fig.). The anatomy of *C. macgregori* Cox, the only species, is unknown. The author figures fragments of a radula which show definitely that the species belongs to the Zonitidæ. Möllendorf had placed it in the Rhytididæ. E. W. B.

The Differentiation as Species of the Two Forms of British Trivia.—A. J. PEILE (*Proc. Malac. Soc.*, 1925, **16**, 195–7, 2 text-figs.). The author has come to the conclusion that the difference between the radulæ of *Trivia* (*Cypræa*) *monacha* and *arctica* warrants the assumption that we have two species of Trivia in British waters. The characters relied upon are the length of the central basal-plate and the presence or absence of accessory cusps on the admedians. The attention of field-workers is drawn to the characters of the living animals. E. W. B.

The South African Species of Onchidella.—H. WATSON (*Ann. South African Museum*, 1925, **20**, 237–308, 62 figs. on 8 pls., 1 map). Onchidella is a genus closely allied to Oncidium. The best known species of Oncidium (*O. celticum*) is here assigned to Onchidella. The author describes two South African species, both new to science. The description is in much detail, and many of the illustrations are photographs of serial sections. One plate shows sections of the radula sac. The suggestion that the "unicellular glands" of the mantle are really rudimentary visual organs is rejected as very improbable; it is admitted that respiration can take place under water for long periods through the skin, and equally long in the air, mainly through the lung.
E. W. B.

Exogenous Nematocysts of Embletonia.—A. NAVILLE ("Sur la présence d'une Embletonia dans le canal de Caen a la mer; origine exogène de ses nématocystes," *C.-R. Acad. sci.*, 1925, **181**, 812–3). Naville has found an *Embletonia*, probably *E. pallida* A. and H., in plenty on *Cordylophora* in the locality named in the title. Cuénot states that the NaCl is only 1 or 2 : 1000. The nematocysts of the *Cordylophora* and the *Embletonia* appear to be identical. Breeding experiments have however not been possible. E. W. B.

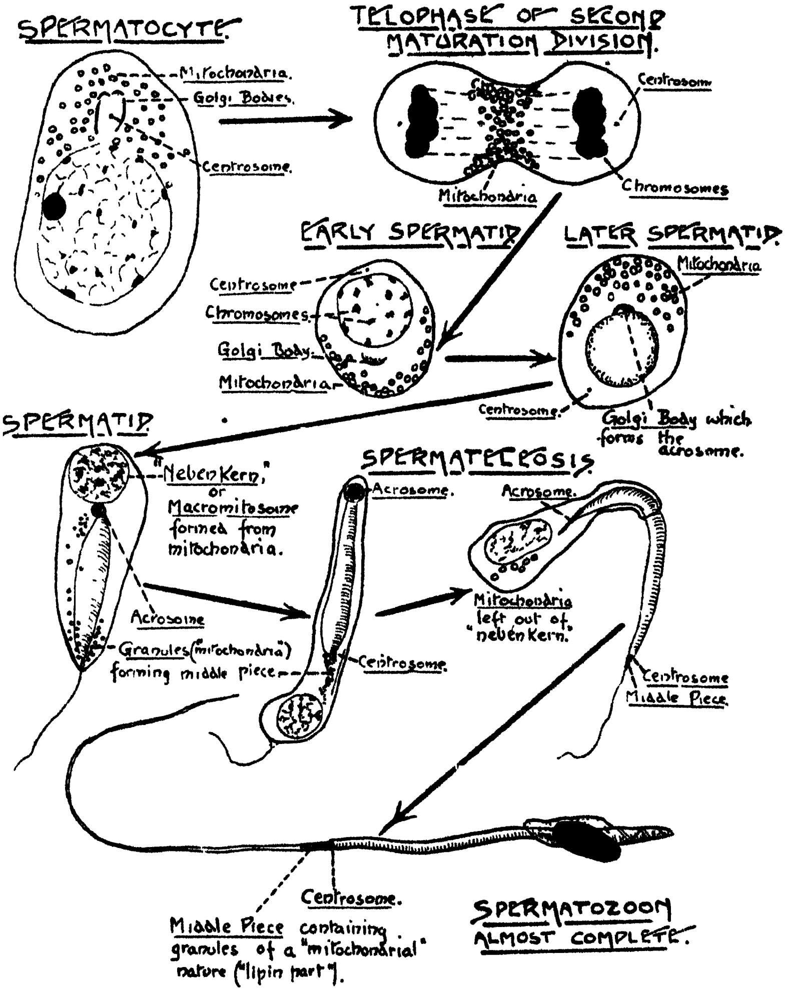
Function of Digitate Glands of the Genus Helix.—P. DORELLO ("Sulla funzione delle glandole digitate nel gen. Helix," *Atti Accad. Lincei* (*Rend.*), 1925, **1** (VI. S.), 47-51). The secretion (digitin) of the digitate (mucous) glands of the genus Helix contains two principles or substances. One of them has a coagulating action and serves to stop the hæmorrhage caused by the dart during copulation; the other is carried by the same dart, together with some of the secretion, inside the body of the animal acting as female, and stimulates its generative organs. C. D. F.

Arthropoda.

β Myriopoda.

Reaction of a Tissue to Parasitism.—PH. JOYET-LAVERGNE ("Sur les réactions d'un tissu au parasitisme; la lipoidogenèse et la lipogenèse," *C.-R. Acad. sci.*, 1925, **180**, 878–80). In the intestinal epithelium of *Scolopendra cingulata* lipoids and fats are produced under the influence of the sporozoa parasites *Nina gracilis* and *Adelina dimidiata*. This lipoido- and lipo-genesis cannot be considered as degenerative, because they favourably influence the metabolism of the host. C. D. F.

Spermatogenesis of Peripatus.—J. B. GATENBY ("A Reinvestigation of the Spermatogenesis of Peripatus," *Q. J. Microsc. Sci.*, 1925, **69**, 629–42, 1 pl., 1 text-fig.).


SPERMATOCYTE.
Mitochondria.
Golgi Bodies.
Centrosome.
TELOPHASE OF SECOND MATURATION DIVISION.
Centrosome
Chromosomes
Mitochondria
EARLY SPERMATID
Centrosome
Chromosomes
Golgi Body.
Mitochondria
LATER SPERMATID.
Mitochondria
Centrosome.
Golgi Body which forms the acrosome.
SPERMATID
"Nebenkern," or Macromitosome formed from mitochondria.
Acrosome
Granules (mitochondria) forming middle piece
SPERMATELEOSIS
Acrosome.
Centrosome.
Acrosome.
Mitochondria left out of "nebenKern."
Centrosome
Middle Piece.
Centrosome.
Middle Piece containing granules of a "mitochondrial" nature ("lipin part").
SPERMATOZOON ALMOST COMPLETE.

R. J. L.

ε. Crustacea.

The Experimental Amœbocyte-tissue of Limulus.—L. LOEB, H. BEERMAN and IDA P. GENTHER ("The effect of various ions on the experimental amœbocyte-tissue of Limulus and their interaction with other variable factors," *Arch. exper. Zellforsch.*, 1925, **1**, 257–88). Experimental amœbocyte-tissue consists of layers of agglutinated amœbocytes obtained from the blood of Limulus under conditions which ensure the least possible injury to the cells. This tissue-like material can be cut into small pieces and used in tissue-culture experiments. The amœbocytes wander out centrifugally from the pieces and produce secondarily structures resembling mesenchymatous tissue. The effect of Na, K, Ca, NH_4, NO_3, Cl, SO_4 ions on the amœbocyte-tissue varies according to the character and concentration of the ions, the osmotic pressure of their solutions, the character of the tissue, and other variable factors. K diminishes the normal plasticity of the amœbocytes, but this change may result in an increased fluidity or an increased rigidity according to the concentration of the salt and osmotic pressure of the solution used. SO_4 tends to harden the tissue. The effect of various combinations of the ions above mentioned can to a certain extent be predicted if the effect of the individual ions is known. Healthy tissue is much less affected by the composition of the surrounding medium than less resistant tissue, provided the effects of the ions do not exceed a certain range. The effect of various media on the character of the amœbocytes, their pseudopodia and movements is correlated with the width of outgrowth of the tissue, the spreading out and secondary transformation of the cells, the agglutination of the amœbocytes to one another, the quality of the glass and the rapidity of degeneration which tissues undergo with the progress of time. The degeneration of less resistant tissues largely depends upon the nature of the solutions used and the disintegrating effect of various ion-combinations on the amœboid movement and consistency of the individual cells. C. D. F.

Echinodermata.

Maturation and Activation of the Egg of Asterias glacialis.—A. DALCQ ("Recherches expérimentales et cytologiques sur la maturation et l'activation de l'œuf d'Asterias glacialis," *Arch. biol.*, 1924–5, **34**, 507–669, 41 figs. and 3 pls.). The oöcyte of this starfish enters the maturation phase only if its protoplasm contains a certain amount of calcium, while maturation itself is considerably influenced by the physico-chemical conditions of the medium in which the eggs are kept. The term "depolarization" is used to indicate phenomena mainly characterized by an increase in size of the maturation aster, and a tendency of the same karyokinetic figure to move away from the animal pole. Maturation, depolarization and segmentation can be provoked by transferring the egg-cells from the ovary into an isotonic or slightly hypotonic solution of $CaCl_2$, NaCl, KCl and $MgCl_2$ in sea-water. This chemical activation is due to the gradual penetration of the cations

NaCl, KCl and $MgCl_2$ into the egg, where they alter the equilibrium of the existing cations to the advantage of Ca, which can then activate the egg. Hence the conclusion that the polarity of the oöcyte influences the electrostatic properties of the plasmatic membrane ; this as well as the centrosphere have a positive electric charge decreasing from the vegetative towards the animal pole. C. D. F.

Protozoa.

Encystation of Giardia lamblia from Man.—ROBERT W. HEGNER (*Amer. J. Hygiene*, 1925, **5**, 250–7, 12 figs.). Hitherto there has been no observation of the encystation of Giardia, but types from a human patient have now been studied. The nuclei of the cysts show changes in size and in the distribution of their chromatin which is at first in the form of a solid karyosome. They enlarge, and the chromatin resolves itself into granules which are scattered throughout the nuclear substance. J A. T.

Chain-forming in Colpidium. — EDOUARD CHATTON et MME. CHATTON (*Revue Suisse Zool.*, 1925, **32**, 99–105, 10 figs). Monstrous forms and chains of *Colpidium campylum* and *C. colpoda* are found to be due to the presence of *Bacillus coli* in the medium. Experiments show that the injurious influence frequently induces the appearance of dystomatous forms—two individuals hanging together, the outcome of a division that cannot complete itself. The influence manifests itself twenty-four to forty-eight hours after the introduction of the bacillus ; it seems to be a dyspeptic influence following the digestion of the bacillus by the infusorian. Similar phenomena described by Jennings in Paramecium have probably a similar origin ; but the influence is probably due to specific micro-organism in each case, for the bacillus which was so injurious to Colpidium had no appreciable effect on Paramecium, Glaucoma, or Chilodon. J. A. T.

A Heliozoon Parasitic on Ciliates—A. WETZEL ("Zur Morphologie und Biologie von Raphidocystis infestans n. sp., einem temporär auf Ciliaten parasitierenden Heliozoon," *Arch. Protistenk.*, 1925–6, **53**, 135–12, 28 text-figs.). In this paper a full description of the structure and mode of life of this new species of Raphidocystis is given. As opportunity offers it will prey on small flagellates, or attach itself parasitically to large ciliates. It shows a tendency to colony-formation and plastogamy, a number of parasitic individuals often fusing to engulf the host. The skeleton can be broken through by the pseudopodia and is abandoned before encystment. S. D. K.

Axopodia of the Heliozoa and Tentacles of the Ephelotidæ.—GR. ROSKIN ("Über die Axopodien der Heliozoa und die Greiftentakeln der Ephelotidæ," *Arch. Protistenk.*, 1925, **52**, 207–16, 9 text-figs.). A concise account of the development and structure of the axopodia of *Actinosphærium eichhornii* and *Actinophrys sol.* The axial strand is a tube filled with slightly contractile protoplasm, the walls of the tube being composed of adjacent elastic fibrils ; it is compared to the muscle-

fibres of Hydra and the myonemes of Infusoria. The structure of the axial strand in the tentacles of *Ephelota gemmipara* is similar.
S. D. K.

Cytology of Actinosphærium Eichhornii.—A. Rumjantzew and E. Wermel ("Untersuchungen über den Protoplasmabau von Actinosphærium eichhornii," *Arch. Protistenk*, 1925, **52**, 217–64, 6 text-figs., 1 pl.). This paper gives a comprehensive account of the cytoplasmic inclusions of Actinosphærium, with the exception of the Golgi bodies. The occurrence and behaviour of mitochondria, neutral fats and lipoids, glycogen, pellicular granules of an excretory nature, and compounds of albumen and carbohydrates is discussed. The mitochondria are intimately connected with digestion. "Liposomes" resembling mitochondria, but containing more fat, are described in the axopodia.
S. D. K.

Incomplete Fission in Paramecium.—E. Herzfeld ("Über das Vorkommen von Missbildungen und Monstrositäten bei Paramæcium spez," *Jenaische Zeitschr. Naturwiss.*, 1925, **62**, 79–124, 4 text-figs., 2 pls.). Incomplete fission, giving rise to "chains" consisting of two individuals, can be induced experimentally. Various types of incomplete fission are described, and the causes leading to such abnormalities discussed. It is suggested that a study of these monstrosities may throw important light on the normal development and life-processes of Infusoria. S. D. K.

Three New Astomatous Ciliates.—J. I. Poljanskij ("Drei neue parasitische Infusorien aus dem Parenchym einiger Mollusken und Turbellarien," *Arch. Protistenk.*, 1925, **52**, 381–93, 1 pl.). Three astomatous parasites from the tissues of certain molluscs and turbellarians are described in detail, under the new generic name *Dogielella*. This genus is referred to the family *Perezellidæ*, the diagnostic characters of which have been somewhat widened to receive it. S. D. K.

Cannibalism in Stentor.—J. V. Gelei ("Über den Kannibalismus der Stentoren," *Arch. Protistenk.*, 1925, **52**, 404–17, 8 text-figs.). Cannibalism in Stentor is described as an hereditary variation. The engulfing and digestion of victims by the cannibals is discussed.
S. D. K.

Variability in Paramecium.—X. Fermor-Adrianowa ("Die Variabilität von Paramäcien," *Arch. Protistenk.*, 1925, **52**, 418–26, 1 curve). Working on the variation in number of the food vacuoles present in the body, the author establishes the fact that, in Paramecium, variability increases in general with age, but, after endomyxis and conjugation, it approaches the level found in young individuals.
S. D. K.

Relation of Herpetomonas elmassiani to its Plant and Insect Hosts.—F. O. Holmes (*Biol. Bull.*, 1925, **49**, 323–37, 5 text-figs.). The occurrence of this flagellate in the latex system of the milkweed (*Asclepias syriaca* L.) is described. Reasons are given for supposing the insect host to be *Oncopeltus fasciatus*, in which a heavy infection of flagellates is frequently found in the dorsal and anterior lobes of the salivary glands. S. D. K.

Morphology and Mitosis in Trichomonas termopsidis, an Intestinal Flagellate of the Termite Termopsis.—M. ANDREWS (*Biol. Bull.*, 1925, **49**, 69–85, 5 text-figs.). The author gives a detailed description of the structure and mitosis of this parasite. A complicated neuromotor apparatus is described, and a distinction drawn between the chromatic basal rod, underlying the undulating membrane, and the true parabasal body. S. D. K.

On Some Gregarine Parasites of Indian Earthworms.—B. L. BHATIA and G. B. CHATTERJEE (*Arch. Protistenk.*, 1925, **52**, 189–206, 3 pls.). This paper gives a list of the gregarine parasites recorded by the authors from six earthworms of the genera *Pheretima* and *Allolophora*. New species of Rynchocystis (*R. cognettii*), Nematocystis (*N. Nessei* and *N. plurikaryosomata*), and Monocystis (*M. pheretimi*) are described in detail; also a monocystid remarkable for the possession of two spine-like structures resembling epimerites, which has been named *Echinocystis globosa* by the authors. S. D. K.

The Parabasal Apparatus of Flagellata.—O DUBOSCQ ET P. GRASSÉ ("L'appareil parabasal des flagellés et sa signification," *C.-R. Acad. sci.*, 1925, **180**, 477–80). Evidence is brought forward showing that the parabasal apparatus of flagellates is homologous to the idiozome of spermatids, and like this corresponds to the Golgi apparatus of other cells of Metazoa. This agrees with the supposition that the parabasal apparatus is concerned with the production and accumulation of a substance necessary to the function of the flagella. C. D. F.

Inanition in Colpidium colpoda.—J. VIEWEGER ("Recherches sur l'inanition de *Colpidium colpoda* Ehrb.," *Arch. biol.*, 1924–5, **34**, 476–506). In this infusorian inanition is characterized by the utilization of the content of the alimentary vacuoles and by a reduction in volume of the cytoplasm and nucleus. The substances derived from the cytoplasm are assimilated before those of nuclear origin. At a certain stage the reduction in volume of the cytoplasm is checked, up to a point, by the production of vacuoles which soon become filled with water. Death of the infusorian may supervene when a certain amount of nutrient material is still present in the culture medium; it is presumably due to the difficulty of limiting the intensity of the metabolism and accomplishing certain apparently vital functions, such as movement and exchanges with the surroundings. C. D. F.

Rotatoria.

The Russian Rotifer Fauna.—N. N. FADEEV ("Materialy k poznanii͡u fauny kolovratok Rossii. Neskolko zamechanii o skhodstve fauny kolovratok Rossii i Ameriki," *Russ. Hidrobiol. Zhurn.*, 1924, **3**, 72–80, 1 text-fig.). Remarks on the similarity between the Rotifer fauna of America and that of Russia. The author adduces 17 species which are known to occur in Russia but are unknown elsewhere in Europe, and which have either been described originally from American habitats or have been recorded as found there. Twelve of these species have been identified or described by other Russian workers, but he has himself found the remaining five, viz. *Lecane aeganea*, *L. tenuiseta*, *L. pusilla*, *Monostyla virga* and *M. furcata*. D. B.

Rotifer Fauna of Nova Zembla.—M. S. IDELSON ("K. poznanii͡u fauny kolovratok vodoemov Novoi Zemli," *Trudy Plovuchego Morskogo Nauchnogo Instituta, Moscow*, 1925, **12**, 79–99, map and 6 text-figs.). The author states that there exist no earlier papers on this subject, and reports that, in material collected in Nova Zembla in 1921 and 1923, he has found 63 forms, including several possibly new, which he describes and figures but does not name. He also describes a new variety of *Polyarthra platyptera*, viz. var. *dolichoptera*, characterized mainly by its leaping spines being about one-third longer proportionately to the length of the body than in the type form. Among the rarer species identified are *Cathypna ungulata* var. *magna*, *C. rotundata*, *C. intrasinuata*, *C. brevis*, *Pterodina reflexa*, *Metopidia quadricarinata*, *Diurella uncinata* and *D. longistyla*. D. B.

New or Rare Rotifers in Russia.—N. N. FADEEV ("Materialy k poznanii͡u fauny kolovratok Rossii," *Trudy Kharkovskogo Obshchestva Ispytatelei Prirody pri Ukrglavnauke*, 1925, **50**, 3–13, 1 pl.). Fadeev announces the occurrence in Russia of 18 species either very rare or hitherto unknown there—among them a new species, *Monostyla unguitata*, which is compared with *M. stenroosi* as nearest in general form, but differs markedly in the shape of the toe, which terminates in two claws in place of the usual single claw. He also describes a new variety of *Trichocerca rattus*, viz. var. *minor*, much smaller in size than the type, and having a plumper body distinctly shorter than the toe. Among the rarer forms described are *Diaschiza tenuiseta*, *Proalides tentaculatus*, *Mikrocodides robustus*, *Brachionus mollis*, *Lecane grandis*, *Notommata pseudocerberus*, *Epiphanes brachionus* var. *spinosus*, *Cyrtonia tuba*, *Colurella sulcata* and *Asplanchnopus hyalinus*. D. B.

Rotifers from Inland Salt Waters.—J. HAUER ("Rotatorien aus den Salzgewässern von Oldesloe (Holstein)," *Mitt. Geog. Ges. Naturh. Mus. Lübeck* (2 Reihe), 1925, 152–95, 16 text-figs.). A table is given of 29 forms found in salt wells and other salt-impregnated waters at Oldesloe. Among them are six species hitherto unrecorded for Germany. The more rare forms are described and figured, the most noteworthy being *Pedalia oxyure*, *Colurella dicentra*, *Euchlanis plicata*, *Lecane ichthyoura*, *L. nana* and *Proales similis*. Of these only *Colurella dicentra* and *Pedalia oxyure* have been found in Britain. D. B.

BOTANY.

(*Under the direction of* DR. A. B. RENDLE.)

GENERAL,

Including the Anatomy and Physiology of Seed Plants.

Cytology,

Including Cell-Contents.

Plastids in the Generative Cells.—ANNA LUXENBURGOWA (*Acta Soc. Bot. Polon. Warszawa*, 1925, 228–31, 6 figs.). A preliminary note dealing with the discovery of plastids in the generative cells of *Cephalotaxus* and *Torreya*. Shortly after dehiscence the pollen-grains consist of two cells—a large pollen-tube-cell and a generative cell. The tube-cell contains 4–20 plastids associated with starch-grains, forming a conspicuous cluster round the nucleus; the generative cell contains fewer, usually about fourteen, and they are far less conspicuous. Although the presence of plastids and starch-grains in the generative cells may be one of the numerous abnormalities observed in Conifers at the time of fertilization, the discovery is of interest, since it confirms the observations made by W. Ruhland and E. Wetzel in other plants. The author hopes to make further contributions upon the same problem, at an early date. S. G.

Details of the Equatorial Crown in Yucca recurva.—Z. WOYCICKI (*Tom. cit.*, 232–8, 1 pl.). An account of the discovery of certain details in the equatorial crown of root-cells of *Y. recurva* Salisb. In previous descriptions the chromosomes of the equatorial crown are said to be quite free and independent, while photographs are too indistinct to make out the finest details. During the photography of preparations of cells in the act of mitosis the author discovered that the chromosomes are united to each other by specific trabeculæ, which are independent of the spindle and have nothing in common with it. Close examination of photographs made by other investigators of root-cells in *Galtonia candicans* indicates that a larger magnification would probably reveal the existence of similar trabeculæ in this species, and possibly also in others. S. G.

Plastids in the Egg-cell of Podophyllum peltatum.—KAROLINA LUBLINEROWNA (*Tom. cit.*, 225–7, 1 fig.). An account of the starch-grains and plastids found in the embryo-sac of *P. peltatum*. The starch-grains are of the variety known as "red starch," and are so numerous in the egg-cell that the plasma is thick with them, and they cover the nucleus. After fertilization the starch-grains and plastids are very distinct, both in the egg-cell and the daughter-cells, being visible even in the quadrant stage, although far less numerous than in the unfertilized egg-cell. S. G.

Effect of Wounds upon the Rotation of Protoplasm.—SUSAN P. NICHOLS (*Bull. Torr. Bot. Club*, 1925, **52**, 351–63, 4 figs.). A study of the effect of wounds upon the rotation of the protoplasm in the internodes of *Nitella*. When the wounds were produced by a sharp needle some of the protoplasm (with its contents) issues through the wound into the surrounding water. Shortly afterwards granules accumulate round the opening and soon form a plug which prevents further loss of protoplasm; this is followed by the formation of a membrane continuous with the cell-wall. Immediately after the formation of the wound the streaming of the protoplasm ceases, but the total effect varies with the size and depth of the wound. The first wound has a more marked effect than later ones. If the needle is so sharp that it enters the cell-wall without resistance the streaming of the protoplasm is only affected in the neighbourhood of the wound. A quick thrust of the needle affects streaming much more than a slow one. When the needle is dull the resistance of the cell-wall causes a vibration which is accompanied by immediate cessation of movement throughout the cell. The healing of the wound is similar in every case. Movement is resumed gradually here and there until all parts are streaming except that in the immediate neighbourhood of the wound. Toxic substances liberated by the injured protoplasm appear to be responsible for the interference in streaming of the protoplasm and for the behaviour of the plastids. The increased immunity to toxic substances resulting from repeated wounding suggests the possibility of the formation of an anti-toxin in the protoplasm. S. G.

Cultures of Vegetable Tissues.—W. LAMPRECHT ("Über die Züchtung pflanzicher Gewebe," *Arch. exper. Zellforsch.*, 1925, **1**, 412–23). Vegetable tissues and cells can be preserved alive and practically unaltered in cultures *in vitro*. The cells may show phenomena of protoplasmic fluidification, increase in size and shifting of the nucleus. They also multiply, but only under the influence of a stimulus which is not due to the wounds made when cutting the cultivated fragments, but to a substance capable of causing cell-division. This is contained either in the meristem, or in the embryo or in the leptome, or it arises from the autolysis of the wounded and dying cells. C. D. F.

Structure and Development.

Vegetative.

Resin-canals in the Canadian Spruce (Picea canadensis (Mile.) B. S. P.): An Anatomical Study in Relation to Traumatic Effects and their Bearing on Phylogeny.—R. B. THOMSON and H. B. SIFTON (*Phil. Trans. Roy. Soc.*, 1925, Ser. B, **214**, 63–111, 7 pls., 6 figs.). No evidence was found of anastomosis between the vertical and horizontal systems or between the canals of the wood and the bast in the stem. The same is true of the seedling root, though in the distal roots of mature trees a certain amount of anastomosis does occur. With the exception of those in the primary cortex of the stem, and possibly in the root-wood of mature trees, the resin-canals in *Picea* are composed of series of cysts separated by parenchyma. When the horizontal canals enter the bast they become characterized by series of bulbous expansions which, in transverse section, may be mistaken for vertical canals. Horizontal canals are confined to the secondary medullary rays and are never found in the primary. They originate in association with vertical canals in the wood. That increased food supply or great vigour of growth is the prime cause of resin-canal production is disproved by the lack of correlation between these factors and the distribution of canals in *Picea*. Their sporadic occurrence suggested that the causal agency might be wounding or other external accidental factor. In the secondary tissues of young spruce growing in protected situations resin-canals are often lacking from the first few years' growth. They occur earlier and in greater abundance where the plants are more exposed to injury. When the canals are present in secondary tissues they are always found to be connected with evidence of injury. It is therefore concluded that all resin-canals in secondary tissues of *Picea* are caused by injury to, or irritation of, the cambium. The traumatic canals are not limited to a close tangential series, but spread out radially and tangentially, becoming more diffuse as the distance from the wound increases. The evidence favours the hypothesis of a phylogenetic increase of sensitiveness to wounds among conifers. B. J. R.

Reproductive.

Embryogeny of Cephalotaxus Fortunei.– J. T. BUCHHOLZ (*Bull. Torr. Bot. Club*, 1925, **52**, 311–23, 1 pl., 2 figs.). A study of the embryogeny of *Cephalotaxus*, which, taken in conjunction with morphological facts previously discovered, may throw light on the affinities of this genus. The embryo is derived by cleavage from a polyembryo. Most of the early cells of the pro-embryo appear to be embryo initial-cells. The terminal cells form the cap, the next group forms the single embryo. The tier above this group becomes the primary suspensor, while the uppermost rosette-cells retain fully their capacity for embryo-formation and usually give rise to several rosette embryos. No clear evidence was obtained of the cleavage of the primary embryo. In the later embryo the stem-tip appears long after the formation of the dermatogen, periblem, plerome, root-cap and cotyledons. The dermatogen arises early and extends over the root-cap to the suspensor. In the later stages a cavity is formed by disintegration of the middle cells of the plerome. There are usually two cotyledons. S. G.

CRYPTOGAMS.

Pteridophyta.

Occurrence of Cavity Parenchyma and Tyloses in Ferns.— H. S. HOLDEN (*Journ. Linn. Soc.* (*Bot.*), 1925, **47**, 141–53, 25 text-figs.). In 1908 Miss McNichol published her observations "On Cavity Parenchyma and Tyloses in Ferns" (*Annals of Botany*, **22**).

H. S. Holden now adds an account of his own investigations. He finds that cavity parenchyma in ferns, though generally confined to the petiolar protoxylem, frequently occurs in similar areas in the rhizomes of *Pteridium aquilinum*, chiefly in the outer ring of meristeles, but only occasionally in the inner system. It also occurs sometimes in the rhizome of *Matonia pectinata*. An analogous formation may occur in the internodal carinal canals of the rhizome of *Equisetum arvense* as a result of wounding. True tyloses, producing an occlusion of the metaxylem, occur in wounded roots of *Marattia fraxinea*; and these may become lignified. The author reviews the evidence as to the nature of the growths occluding the metaxylem elements in the fossil fern *Ankyropteris corrugata*, and inclines to regard them as true tyloses. A. G.

Polembryony in Certain Polypodiaceæ and Osmundaceæ.—DAVID M. MOTTIER (*Bot. Gazette*, 1925, **80**, 330–6, 3 figs.). An investigation of polyembryony in ferns arising from the experiments of A. Etter published in 1923 (*Bull. Torr. Bot. Club*, **50**, 95–107). The summary of the present results is that under experimental conditions individual prothallia of *Dryopteris mollis*, *Mattueccia nodulosa*, as well as some other Polypodiaceæ and *Osmunda Claytoniana*, may be made to produce from two to many sporophytes. If the prothallia are allowed to attain a width of 1–1·5 cm. across the wings before fecundation, some five independent self-nourishing sporophytes may be developed before the gametophyte is exhausted; but if the sporophytes are carefully amputated as soon as they become plainly visible, a succession of sporophytes can be produced on an individual prothallium. If the massive prothallia develop proliferations as a result of the experimental cultivation, from ten to fifteen or more sporophytes may be produced. A. G.

Development of Prothallium and Apogamous Embryo in Pellaea glabella Mett.—F. L. PICKETT and MILDRED E. MANUEL (*Bull. Torr. Bot. Club*, 1925, **52**, 507–14, 32 figs. in text). An investigation of the gametophyte of *Pellaea glabella*. The prothallia develop normally from the spore and show the usual reactions to growth conditions. They sometimes produce normal antheridia and sperms, but no archegonia; hence sporophytes are produced apogamously only. Apogamous embryos arise through the activity of cell masses involving comparatively mature tissue of the prothallia. A. G.

Bryophyta.

Number of Chloroplasts in the Cells of the Sporophyte of Anthoceros lævis.—ATHA A. PINNICK (*Tom. cit.*, 515–8). A résumé of the statements of various authors as to the number of chloroplasts in the cells of the sporophyte of *Anthoceros*, and an account of investigations made by the writer. In the spore mother-cell the chloroplast is solitary until the cell divides. The cells of the gametophyte contain one large chloroplast. Carefully prepared microtome sections of the sporophyte showed almost without exception that the chloroplast is solitary in the cells of *A. lævis*; freehand sections of fresh material sometimes seemed to reveal two chloroplasts in a cell, but this was probably due to invisibility of the very delicate walls separating two contiguous cells. And where older writers have recorded double chloroplasts in the sporophyte of *Anthoceros*, it is possibly owing to faulty methods of observation. A. G.

Taxonomic Study of Hymenophytum.—ALEXANDER W. EVANS (*Tom. cit.*, 491–506, 19 text-figs.). A detailed discussion of several plants which have been referred as distinct species to the genus *Hymenophytum* and to some other genera, and a convincing conclusion that they are but forms of one widely distributed species, *H. flabellatum* (Labill.) Dumort. In this are now merged *Symphyogyna leptopoda* Tayl., *Metzgeria rugulosa* Col., six species of *Symphyogyna* from New Zealand described by Colenso, *S. integerrima* Steph., *Hymenophytum pedicellatum* Steph., *H. furcatum* Pears. The geographical distribution extends from Australia, Tasmania, New Zealand, to New Caledonia, Fiji, Juan Fernandez, Chile and Colombia. A. G.

Revision of the Species of Radula of the United States and Canada.—HEMPSTEAD CASTLE (*Tom. cit.*, 409–45, 11 figs.). A systematic account of the North American species of *Radula*, with detailed descriptions of the genus, and its eleven species, and figures showing habit and structure; also critical notes, synonymy, distribution, and a helpful key to the species. A. G.

Moss Distribution in Sweden. IX. Bartramiaceæ.—HJALMAR MÖLLER (*Arkiv för Botanik*, 1925, **19.** 3, 147, 40 text-figs. and 5 tables). An account of the Swedish species of Bartramiaceæ, and their distribution, including *Philonotis* with eight species and eleven varieties, *Bartramia* with three species and four varieties, *Plagiopus* and *Conostomum*, each with one species. By means of a key, text-figures and critical notes, an attempt is made to meet the difficulties presented by the forms of *Philonotis*. A. G.

Abnormal Archegonium of Funaria hygrometrica.—F. M. ANDREWS (*Bot. Gazette*, 1925, **80**, 337, fig.). A note describing and figuring an archegonium of *Funaria* containing two egg-cells, a normal row of canal-cells and part of a second row (two canal-cells and a ventral canal-cell). The two egg-cells are rather large and are situated side by side. Allusion is made to the occurrence of twin egg-cells in *Bryum cæspiticium*, *Mnium*, and *Polytrichum juniperinum*. A. G.

Thallophyta.

Algæ.

Two New Salt-water Flagellatæ from near Öresund.—L. GUNNAR SJÖSTEDT (*Lunds Universitets Årsskrift.*, 1924, N.F. Avd. 2, Bd. 20, Nr. 5, 1–20, figs.). Descriptions and biological data of *Peridinium umbo*, a new species, and *Aspidiophora viridissima*, the type of a new genus of Coccolithophorideæ. A. G.

Variation and Species in Cyanophyceæ. - W. B. Crow (*Journal of Genetics*, 1924, **14**, 397–424, 8 text-figs.). The author finds that the systematic characters of the Cyanophyceæ can generally be reduced to differences in the degree of development of a few main types of structure. These differences are correlated with the asexual means of reproduction, the peculiar cytological characters, and the special physiological properties of the protoplasm. Evidence is offered in support of the view that direct environmental influences on the reproductive cells play a part in inducing this fundamental kind of variation.
A. G.

Notes on Diatoms: No. 3. – F. W. Payne (*Journal of Botany*, 1925, **63**, 256–62, 3 figs.). A description and discussion of the structure and meaning of the forms of *Ditylum* found in some plankton from Hongkong. The fission by which these forms are reproduced is not the normal fission into two. The frustule developed only one new frustule; the second, oldest, valve being barren is pushed off as the newcomer grows to full size. This was observed in more than a hundred cases. Two forms of secondary frustule were observed. These forms cannot be regarded as a definite species of *Ditylum*; but probably represent a phase in the life-history of some (perhaps well-known) diatom. The secondary frustules may be resting spores of *Ditylum sol*. with which they are associated. And they closely resemble *D. trigonum* and *D. inæquale*, found by Professor Bailey in a Para River gathering. The method employed for dissecting these diatoms is described. In the second chapter is a description and figure showing how Ehrenberg's *Ophidocampa tridenaria* has been dissected by Mr. Payne into a valve of *Eunotia* and an internal cast, comparable to the case of *Liostephania* which was proved by him in 1922 to be a cast of a frustule of *Asterolampra*.
A. G.

Phytoplankton of the Inland Lakes of Wisconsin. Part II. Desmidiaceæ.—Gilbert Morgan Smith (*Bull. Univ. Wisconsin*, 1924, Bulletin **57**, 1–227, pls. 52–88, 17 text-figs.). Part I. of this work appeared in 1920, and treated of the plankton algæ other than the desmids and diatoms. We now have the desmids; and the diatoms will be presented in Part III. The plan followed by the author is to give keys to the genera and species, a description of each genus, species, &c., with citation of literature and published figures, details of distribution and frequency. The copious figures in the plates have been drawn from Wisconsin material. The figures in the text represent typical specimens from other sources.
A. G.

Variation and Hybridization in Isokontæ and Akontæ in Relation to Classification.—W. B. Crow (*Journal of Genetics*, 1924, **14**, 115–28). The characters used for distinguishing the classes of algæ are based on the reproductive cells, the nature of the cell wall, the chromatophores, the cell products. But in the smaller groups, the orders, a different set of characters is used. For instance, in the Isokontæ and Akontæ we pay attention to colony formation, cœnocytic habit, relative duration of phases in the life-history, degree of sexual differentiation, degree of division in the sporangium or gametangium. The same features serve in the determination of the families, while in genera and species there are numerous changes in detail of form in chromatophore, cell, colony and thallus. The differences of species in Isokontæ and Akontæ are sometimes compatible with an origin by hybridization, and sometimes analogous with those due to special conditions of the environment.

A. G.

Rate of Growth of Valonia macrophysa.—MATILDA MOLDENHAUER BROOKS (*American Journal of Botany*, 1925, **12**, 617–8, fig.). A note on the measurement of the rate of growth of *Valonia macrophysa* under laboratory conditions. The results are shown in a figure and a table.

A. G.

Notes on Microdictyon.—W. A. SETCHELL (*Univ. of California Publications in Botany*, 1925, **13**, 101–7). Preliminary notes on an investigation of the confused misunderstanding of the species of *Microdictyon*. Such egregious blunders have been made by past authors through not having seen the original types that it is impossible to establish new species until the older ones are precisely defined. Setchell discusses these matters, presents us with a provisional key for distinguishing the species, and describes a few new species. A. G.

Important Problem of Vegetable Palæontology (the Calcareous Siphoneous Algæ).—J. COSTANTIN (*Ann. Sci. Nat. Bot.*, 1925, Ser. 10, **7**, 793–99, 9 figs.). An account of some large unpublished drawings prepared by Munier-Chalmas, and preserved in the Muséum d'Histoire Naturelle at Paris, designed to reveal the facts discovered by him as to the fossil Siphoneous Algæ. Munier-Chalmas's original manuscripts have been studied by Jean and Lucien Morellet, and most of the types have been carefully described by them, but not all. J. Costantin now publishes a figure of *Hagenmülleria* from Munier-Chalmas's drawing, and also provides a valuable key to the verticillate Siphoneous Algæ of the Tertiary strata of Paris, as defined by MM. Morellet These fall into five tribes:—1. Dasycladeæ (*Cymopolia*, *Meminella*, *Larvaria*, *Neomeris*, *Lemoinella*). 2. Bornetelleæ (*Dactylopora*, *Zittelina*, *Digitella*, *Iodotella*, *Terquemella*, *Maupasia*). 3. Acetabularieæ (*Acicularia*, *Briardina*, *Clypeina*). 4. Thyrsoporellideæ (*Thyrsoporella*, *Gumbellina*). 5. Utericeæ (*Uteria*). A. G.

Male Organs of the Florideæ.—VIOLET M. GRUBB (*Journ. Linn. Soc.* (*Bot.*), 1925, **47**, 177–255, 36 text-figs.). An historical account of the spermatia of Florideæ is given, followed by chapters on terminology; material and methods; a detailed investigation of the antheridial structures in species of *Chondrus*, *Lomentaria*, *Champia*, *Nitophyllum*, *Laurencia*, *Polysiphonia*, *Griffithsia*, *Halurus*, *Callithamnion*, *Ceramium*, *Dumontia*, *Furcellaria*; position of the antheridia; position and structure of the antheridial mother-cells; development of the antheridia and spermatia; cytology of spermatial development; homologies of the antheridia; classification of the Florideæ on the basis of spermatial types; summary of results; and, finally, a bibliography of eighty-three papers. A. G.

Vacuolar Pseudopodia in a Species of Callithamnion.—Reginald W. Phillips (*Revue Algologique*, 1925, **2**, 14–18, 3 text-figs.). A description of a curious tuft of protoplasmic pseudopodia projecting into the vacuole from the transverse septa of the long axial cells of a *Callithamnion* found on the Welsh coast. These pseudopodia vary in number, shape, and size; they are in constant movement, and along them granules are seen to pass. The movements may be observed for some hours after the plant is taken from the sea. The pseudopodia seem to be a special development arising from the streaming of the protoplasm; and they appear to exist for the purpose of respiration rather than of nutrition. A. G.

Fungi.

Features of Growth and Reproduction in Sporodinia grandis.—Wilfrid Robinson (*Trans. Brit. Mycol. Soc.*, 1926, **10**, 307–14, 2 figs.). The fungus, a member of the Mucorineæ, is a well-known parasite on the sporophores of Agarics, and forms zygospores readily and constantly. It grows also freely on culture media rich in sugars. The problem was to discover the external factors that induced the formation of the spores. Cultures were made under varying conditions, and the primary factors inducing the reproductive development appeared to be "internal metabolic changes associated with a diminution of growth." The nature of the medium and the degree of humidity also come into play. If the medium has been relatively concentrated in carbohydrate, and the humidity over the culture is high, zygosporic tufts are developed; with reverse conditions sporangial tufts are formed. A. L. S.

Research on Sexuality and Parasitism in the Mucorini.—H. Burgeff (*Bot. Abhandl. von K. Goebel*, 1924, **4**, 1–135, 4 pls., 43 figs.; see also *Hedwigia*, 1926, **66**, *Beibl.* 6–7). Burgeff has experimented by cultures with many forms of Mucorini, and has attacked many problems. Parasitism in the family has arisen, he considers, through hybrid copulation. He has obtained what he terms legitimate copulation in a number of heterothallic genera and species, as also in homothallic forms. Illegitimate sexual reactions have been observed on cross-fertilization between heterothallic and other heterothallic forms, as, for instance, between *Absidia glauca* and *Rhizopus nigricans*, and several others pairs homothallic with heterothallic, as with *Absidia spinosa* and *A. glauca*, and *Zygorrhynchus exponens* with *Mucor hiemalis*. He also describes the physiological development of the sexual process and the transition from vegetative to sexual conditions. Other problems are considered at length, such as the development of parasitism. A. L. S.

Cladochytrium Myriophylli Rostr.—J. S. L. Waldie (*Trans. Brit. Mycol. Soc.*, 1926, **10**, 316–17). The fungus has been found in Scotland, probably from Perthshire, on *Myriophyllum verticillatum*. It formed thick brownish tumours on the stems, and underneath in the intercellular spaces of the host tissue were found large, ellipsoidal to spherical spores, about 30μ across. These resting spores are filled with large globules of yellow oil. A. L. S.

Contribution to the Study of the Genus Ligniera.—M. FRON and MDLLE. GAILLAT (*Bull. Soc. Mycol. France*, 1926, **41**, 388–90, 1 pl.). The authors found the parasite restricted to the roots of *Poa annua*, the root-hairs of which were deformed by the presence of *Ligniera* in the cells. The species has been described as *L. pilorum* n. sp. It forms sporogonia by the massing of amœbæ in the root-hair and occupying the terminal inflation of the hair. Within the sporogonia are formed the sporocysts which eventually produce zoospores. A. L. S.

Morphology of Conidiobolus villosus n. sp.—G. W. MARTIN (*Bot. Gaz.*, 1925, **80**, 311–18, 1 pl., 2 figs.). Martin found the new species, a parasite of *Hypochnus*, growing in an artificial culture that had been inoculated from rotten wood. The *Hypochnus* was soon crowded out by other fungi. The development of *Conidiobolus* was followed, in different media, as also the formation and discharge of the conidia; no other spore forms were observed. The conidia form has globose swellings on short stout conidiophores, the tips of which intrude into the conidia like a columella. As maturity is reached the base of the conidium puts out a papilla which presses against the columella and thus effects its discharge. These conidia become transformed into resting spores with dark thicker walls, and with hair-like appendages.
A. L. S.

Asterineæ: Studies on the Systematy of Pyrenomycetous Fungi.—G. ARNAUD (*Ann. Sci. Nat. Bot.*, 1925, Ser. 10, **7**, 643–723, 16 pls, 25 figs.). Under the general heading Asterineæ Arnaud groups those members of the Pyrenomycetes that live on the surface of plants—a biological group. In the present paper he takes up the study of the Myriangiales and the Atichiales as primitive Pyrenomycetes; the former including many families and genera, the latter with one genus, *Atichia*. Both are characterized by globose or ovoid asci dispersed through the stroma, the wall of which is in general undifferentiated from the deeper tissue. In Atichiales the ovoid asci are somewhat more converged into a rudimentary hymenium, and therefore more advanced than the Myriangiales. A systematic key is also given of the more advanced orders. Arnaud in his reasoned arrangement finds that many genera previously published are redundant The species are described, and a full synonymy is given. Many illustrations are given in the text and in the large number of plates. A. L. S.

Species of Meliola and Irene from British Guiana and Trinidad.—F. L. STEVENS and L. R. TEHON (*Mycologia*, 1926, **18**, 1–22, 2 pls.). A preliminary account is given of typical development of the fruiting bodies of the genera dealt with, the chief distinction between *Meliola* and *Irene* being in the absence of setæ in the latter genus The varying forms of perithecia are noted; these may be spherical or dimidiate, and the authors conclude that the latter type represents a more advanced development than the spherical A large number of new species were collected, and are described and figured. A. L. S.

Additional Records of Ctenomyces serratus Eidam.—R. W. MARSH (*Trans. Brit. Mycol. Soc.*, 1926, **10**, 314–16). The authors found this microscopic Ascomycete on pots containing seedlings of pine and of *Cistus*. The pine seedlings had been inoculated with *Rœsleria*, and the fungus was found on or near the area of inoculation, a chance association only. Cultures of the fungus gave no other stage of development. A. L. S.

Heterothallism of the Genus Penicillium.—H. G Derx (*Bull. Soc. Mycol. France*, 1926, **41**, 375–81). The author gives an account of *Penicillium luteum*, the species he specially studied in the formation of its perithecia. In a general culture of spores he had many small isolated cultures of hyphæ, not all alike, but none of them forming perithecia. One group formed an excessive quantity of crystals of oxalate of calcium and liquefied the medium; other groups coloured the medium red but did not liquefy. Though absolutely sterile when grown alone, if the groups were associated in certain combinations perithecia were abundantly produced. The heterothallic nature of the *Penicillium* cultures was thus completely verified A. L. S.

Observations on Illosporium carneum.—Charles Killian and R.-G. Werner (*Tom. cit.*, 382–4, 1 pl.). This fungus is a well-known parasite of the lichen *Peltigera canina*. The authors failed to induce growth on any culture medium, thereby proving the obligative nature of the parasitism: the fungal hyphæ do, however, no damage to the host. The life-cycle was followed and the connection proved with *Nectria lichenicola*, of which *Illosporium* is the conidial form. A. L. S.

Geopara Michaelis.—N. Patouillard (*Tom. cit.*, 313–14, 1 fig.). The author describes this rare fungus hitherto only recorded from Germany, but now found at several places in France. It is one of the underground Tuberaceæ, and agrees exactly with the genus *Paurocotylis* except in a slight difference in spore coloration. A. L. S.

Occurrence in Britain of the Conidial State of Sclerotinia Cydoniæ.—H. Wormald *Trans. Brit. Mycol. Soc.*, 1926, **10**, 303–6, 1 pl.). The conidial stage of this fungus caused dark coloured blotches on medlar leaves, and eventually conidial fructifications of the *Monilia* type were formed. At a later stage an apothecial form developed from mummified flowers collected underneath trees infected with the dark blotches. Similar blotches have been found on the quince, *Cydonia vulgaris*, with conidia similar to those on the medlar, but smaller. Since the first finding at East Malling it has been reported from Wisley. A. L. S.

Grass Rusts of South America, based on the Holway Collections.—J. C. Arthur (*Proc. Amer. Phil. Soc.*, 1925, **64**, 131–223, 10 figs.). Arthur gives an account of Professor and Mrs. Holway's activities in rust studies and collections over a period of fifty years. Holway's first botanical explorations took him to the Selkirks and the Canadian Rockies, later to Mexico, Central America, and finally to South America. These journeys are described from the point of view of rust-collecting. Arthur himself has studied the grasses and rusts collected by Holway, and he gives a bibliography of works consulted during the progress of the work. There follows a key to the species, numbering 74. These have been determined over a long period of years by a number of authors, including Arthur and Holway. There is a very full account of the different forms and of the grass hosts. The figures depict peculiar spore characters. A. L. S.

Some New and Interesting Porto Rican Rusts.—FRANK D. KERN and H. H. WHETZEL (*Mycologia*, 1926, **18**, 39–47). The rusts of Porto Rico have received considerable attention from mycologists, but the above authors have found, and now describe, a number of new species of *Uredo*, and they have made new records of other rare forms new to Porto Rico. A. L. S.

Terminology of the Uredinales.—J. C. ARTHUR (*Bot. Gaz.*, 1925, **80**, 219–28). The author explains in this paper his use of terms to indicate the various types of spores. So far as is known there are four kinds of sori in rusts arising at successive intervals in the life-cycle, though not present in all; to these sori he gives the names *pycnium*, *æcium*, *uredinium* and *telium*. The names of the spores correspond with the different sori, such as pycniospores, æciospores, etc. A. L. S.

Fungi from Tonkin.—N. PATOUILLARD (*Bull. Soc. Mycol. France*, 1926, **41**, 337–42, 2 figs.). Patouillard has verified Petch's placing of *Lachnocladium rameale* in the genus *Septobasidium*. He gives also an account of other species in the genus: *S. accumbens*, originally classified as a *Thelephora*, and a new species *S. gossypinum*, the latter with a large resupinate red-brown thallus of loose cottony texture. Figures are given of the probasidia and of the conidia; spores were not seen. A. L. S.

Specificity of some Epiphytic Hymenomycetes with regard to the Substratum.—L. LUTZ (*Tom. cit.*, 345–57). A number of Hymenomycetes grow on any convenient substratum; certain others are confined to one or another tree; it has seemed as if only on these particular hosts could these definite species receive the nourishment desired. In contradiction to that view, it has been found that many of these parasites will grow on artificial media. Lutz has attempted to carry the question further and determine the substances or qualities that attract special fungi. He determined that the forms previously supposed to be entirely restricted to one type of tree could be cultivated, at least vegetatively, on artificial media containing properties very distinct from those in the natural host plant, and he has also proved that there are deterrent substances present in trees that inhibit the growths; when these are removed, then the fungus develops easily. A further question was as to the specific stability of these fungi. *Corticium quercinum* cultivated on another wood with the objectionable substances removed formed orange-yellow carpophores, rising up from the support and then resembling a *Stereum*. And this touches on the constancy of species. The whole subject is discussed at length. A. L. S.

Fixity of Sex in Coprinus radians.—R. VANDENDRIES (*Tom. cit.*, 358–74). The author has proved by a series of artificial cultures that diploid cultures resulting from the crossing of two haplonts of opposite sex produce carpophores which form spores of two sexes in equal number. The presence of clamp connections in the culture was always a sure intimation of ultimate fertility, and they were produced independently of the nature of the culture medium. Oidia appeared only in cultures of one sex, that is, monospermous cultures; they were never found in cultures containing clamp connections. A. L. S.

Leucopaxillus nov. gen.—M. Boursier (*Bull. Soc. Mycol. France*, 1926, **41**, 391–3). Two species are described, *L. paradoxus* and *L. pseudoacerbus*. Both had previously been found and placed, one in the genus *Clitocybe*, the other in *Tricholoma*. The species dealt with have strongly warted spores, thus differing from either of the two genera in which they had been placed. A. L. S.

Polyporus anceps and Polyporus immitis.—C. H. Kauffman (*Mycologia*, 1926, **18**, 27, 1 pl.) These two fungi were both determined by Peck. Doubts have been thrown on their autonomy, and Kauffman has had them under observation for some time. He concludes that they are both good species, and describes the points in which they differ from other related fungi. A. L. S.

Mutinus bambusinus Ed. Fischer.—T. Petch (*Trans. Brit. Mycol. Soc.*, 1926, **10**, 272–82, 3 pls., 1 col.). The species was first collected in the Botanic Gardens, Peradeniya, in 1912—a single specimen only; two years later it appeared again in abundance; in 1923 it sprang up in hundreds. The small eggs grow in clusters; the wall of the head is red and rough, or granular when fresh, somewhat spongy when dried. The gleba is dark olive; the odour is strong, resembling decaying fruits. In several respects it differs from the published description of *M. bambusinus*, but the latter varies so much from different localities that Petch has decided to include the Ceylon specimens in that species. A. L. S.

Mycological Contributions.—G. Moesz (*Botanukai Kozleményck*, 1925, **22**, 39–52, 9 figs. Hungarian with German Résumé [21–27]). This contribution is part of a larger paper, and deals with different fungi with the numbers 55–74. One of the more interesting items is an account of the Gasteromycete *Trichaster melanocephalus*. The other species dealt with are microscopic forms, and mostly parasitic on the higher plants; several are new to science. A. L. S.

Studies in Entomogenous Fungi. VIII. Notes on Beauveria.—T. Petch (*Trans. Brit. Mycol. Soc.*, 1926, **10**, 244–71, 1 fig.). Several species of *Beauveria* live on different insects—locusts, silkworms, etc.; but Petch thinks there are only very few species, *B. globulifera*, *B. Bassiana*, *B. densa*, the others being probably biologic forms. The first to be described under the name *Botrytis Bassiana* appeared as a parasite of the silkworm in Italy. Specimens obtained in Ceylon from various insects were collected and cultured by Petch, and the various results are described. Inoculation experiments also were undertaken, and the results are given. A bibliography adds to the value of the paper. A. L. S.

Fusarium pallens Link.—T. PETCH (*Trans. Brit. Mycol. Soc.*, 1926, **10**, 282–7.) The paper is a study in systematy, and is a contribution to the work of those botanists who are endeavouring definitely to determine the signification and value of the old names, and to weed out those that are superfluous. A. L. S.

General Mycology.—E. M. WAKEFIELD (*Tom. cit.*, 233–9). An account is here given of the mycological foray at Bettws-y-Coed in the autumn of 1924. The details of each day's excursion are given, and of the meetings held in the evening. A very long list of species is appended testifying to the good conditions of locality and weather. The larger Hymenomycetes as usual bulk most largely. A. L. S.

Mycological Contributions: IX.—H. O. JUEL (*Ark. Botanik.*, 1925, **19**, n. 20, 1–10, 2 pls., 2 figs.). Juel describes *Volutella Buxi*, which covered plentifully the leaves of box hedges in the botanical garden at Upsala. In artificial cultures he reproduced the *Volutella* and the perfect fruit-form *Nectriella Rousseliana*. He had also noted that the *Volutella* was infested by a minute parasite, which he also describes in detail, as a new genus and species, *Cibdelia infestans*. It belongs either to the Olpidiaceæ or Monadineæ. Uniciliate zoospores are produced in zoocysts, which swarm and then form amœbæ and globose bodies. A. L. S.

Mycological Notes for 1924.—L. O. OVERHOLTS (*Mycologia*, 1926, **18**, 31–8, 1 pl., 2 figs.). The notes consist of observations on a number of parasitic fungi, such as *Cercospora Boehmeriæ*, *Cladosporium cucumerinum*, and others. He records a species of *Polyporus betulinus* from Washington State, the first record of the fungus to the west of Minnesota. In *Poria semitincta* he found clamp connections occurring occasionally on two sides of the same hypha and at the same point. He also describes and figures a witches'-broom on *Acer platanoides*, though the causal organism was not found. A. L. S.

Study of the Microscopic Fungi of Resin.—CARLO CAPPELLETTI (*Att. R. Accad. Naz. Lincei, Roma*, 1924, Ser. V, **33**, 53–6). The author classifies these resinous fungi into—(*a*) those that are found exclusively on resin of conifers—*Torula resinæ*, *Stysanopsis resinæ*, *Buttorella resinæ*, etc.; (*b*) those that are mainly found on resin itself—*Helminthosporium resinæ*, etc.; and (*c*) those that grow freely on other substances, earth, etc., such as *Stilbella resinæ*, etc. A. L. S.

Symbiosis in Hepatics: Pellia epiphylla and its Commensal Fungus.—J. MAGROU (*Ann. Sci. Nat. Bot.*, 1925, Ser. 10, **7**, 725–78, 15 figs.). The author has divided this work into a series of chapters. In the Introduction (725–32) he discusses the theories as to the evolution of vascular plants from non-vascular, and the influence on development of the invading fungus. One difficulty in the way has been the impossibility of inducing successful culture experiments of the symbiotic fungus. He reviews the work done on other hepatics and their commensal fungus, and the influence exerted by the fungus on development. There follows an account of Distribution of the Fungus in the adult thallus of *Pellia*; the Origin of the Symbiosis and Pure Cultures of *Pellia epiphylla*. Résumé and Conclusion are given at the end of the work. Magrou finds that (1) the fungus is abundant in the old brown leaves that have finished fructification: it is more sparse in green leaves that are beginning to fructify; the sporophytes are rarely invaded. (2) The fungus is in character similar to Mycorrhiza fungi, with non-septate hyphæ, arbuscules and sporangioles, etc. (3) Spores of *Pellia* sown on infested soil germinate, and the thallus formed is soon invaded in all its parts except the terminal meristem. (4) The fungus destroys the chloroplasts of the invaded cells; hence the browning of the median nerve and general degeneration followed by revivification of the parts left intact. (5, 6 and 7) An account of growth on artificial media; finally, the conclusion that the symbiosis reacts on the development of the gametophyte by provoking alternate phases of differentiation and repose. Advice is given as to the preparation of artificial media, and a bibliography of the subjects is appended. A. L. S.

Research on Dermatophytes and other Parasitic Fungi.—LEON GREGORAKI (*Tom. cit.*, 105–444, 28 pls., 1 col.). In this account of medical mycology the author gives first of all an historical account of the earliest recognition of skin troubles, such as ringworm, due to fungi. This was one of the earliest to be known, but others are taken up and discussed in the same way. The cytological researches of the various forms is then detailed, most of the work having been done in the present century. Gregoraki himself has carried out careful cytological research of the different groups, and his methods and results are explained and discussed. The results are shortly stated at the end of the paper. He calls special attention to the pleomorphism of the organisms very often due to degeneration. The new genera proposed by him are:—*Closterosporia*, *Clostero-aleurosporia*, *Chlamydo-aleurosporia*, *Spirallia*, *Aleurosporia*, *Arthrosporia* and *Malassezia*. These replace *Tricophyton*, *Microsporon*, *Achorion*, *Endodermophyton*, and *Epidermophyton*, all, according to Gregoraki, arbitrary genera of confused and mixed import. The author gives a long bibliography. A. L. S.

Cases of Poisoning due to Fungi.—LEON AZOULAY (*Bull. Soc. Mycol. France*, 1926, **41**, 407–16). Dr. Azoulay has reported that cases of poisoning have been more frequent in 1924 than in 1923. The number he has been able to have reported and verified are thirty-one, with seventy-eight persons affected and resulting in the death of thirty-one. The fungus in question was in most cases undoubtedly *Amanita phalloides*, but there have been also reported *A. verna* in one case and *A. virosa* also in one case. In a number of instances it was impossible to be sure of identification. Most of the cases happened in August and September, the time when fungi are most abundant.

A. L. S.

Effects of Certain Acids and their Sodium Salts upon the Growth of Sclerotinia cinerea.—MARIA SHEPPARD DUNN (*Amer. Journ. Bot.*, 1926, **43**, 40–57, 5 figs.). The problem was to test the toxicity of acids on fungi, and *Sclerotinia cinerea* was chosen for experiment on account of the ease and rapidity with which it could be grown in artificial media; peach-agar slants were used for inoculation, Erlenmeyer flasks for fungus-growth. The various methods used and the results of the tests are fully described, and a summary is given of the results observed. Among other data the author states that a slight amount of acidity is beneficial for growth; that there is a fairly narrow zone on the acid side which limits growth; that the toxicity varies according to the power of the acids to penetrate into the living cell; and, in conclusion, that "these results show that the hydrogen-ion is not always the chief factor of toxicity in the effect of various acids upon the germination and growth of fungus spores." A bibliography is given.

A. L. S.

Pectinase of Sclerotinia cinerea.—GEORGE W. MUHLEMAN (*Bot. Gaz.*, 1925, **80**, 325–30.) The fungus attacks and mummifies non-resistant plums. Cultures of the fungus to obtain a mass of mycelium were made on prune juice. No second crop would grow on the juice. The methods of preparing the culture medium and sowing the spores is described. The best sporulation was secured when the fungus was grown on peaches. When the mycelium had grown to the dimensions of a felt it was lifted, cleansed in running water, and a macerating solution was prepared by pressure. The enzyme was then tested on small discs of apple, plum and potato; in 1·5 to 4 hours the apple and plum discs were reduced to a sauce, the potato discs to a fine pulp. The mycelium was best suited for experiment after a growth of 3 to 5 days; it could then be ground up in a mortar in a few minutes. When the ground mass of mycelium showed a light chocolate colour it was then at its best for yielding pectinase. Attempts to secure pectinase solutions from old growths were failures. A. L. S.

Identity of Rhizoctonia lamellifera and Sclerotium bataticola.—W. SMALL (*Trans. Brit. Mycol. Soc.*, 1926, **10**, 287–302, 1 pl.). Small has decided that *Rhizoctonia lamellifera*, which he considered to be a new species, is identical with the above *Sclerotium*; but along with this statement he gives an extension of the host range. The fungus is parasitic as a root disease of tea, coffee, etc. *Sclerotium bataticola* is a sweet-potato rot in America. Inoculation experiments gave few results.

A. L. S.

Wart Disease of Potatoes.—E. M. DOIDGE (*Journ. Dept. Agric. S. Africa*, 1926, **12**, 161–9, 4 figs.). The fungus *Synchitrium endobioticum*, which causes wart disease, appeared in S. Africa in 1922, when two small plots of potatoes in Natal were found to be affected. In 1925 it was found again near to Johannesburg. The author of the paper has fully described the disease and has discussed methods of control and prevention. Finally, she gives the legislative enactments that have been promulgated to try and prevent any entrance into the country of diseased tubers in seed, and to stamp out any signs of disease.

A. L. S.

Bio-chemistry of Plant Diseases. V. Relation between Susceptibility to Brown Rot in Plums and Physical and Chemical Properties.—T. J. WILLIAMS, N. C. PERVIER, and H. D. TRIEBOLD (*Bot. Gaz.*,

1925, **80**, 121–44). The paper records investigations into the susceptibility of different kinds of plums to the attacks of the fungus *Sclerotinia cinerea* at different stages of ripeness. The authors found that, in general, resistant varieties contained more crude fibre in the ripe stage and also more pentosans. They found also that susceptibility increased with the ripeness of the fruit, and that the firmness and resistant power of the skin was paralleled by the firmness of the flesh. When the plums become ripe or over-ripe all varieties become susceptible to brown rot.
A. L. S.

Lichens.

Lichens of the Isle of Pines.—LINCOLN W. RIDDLE (*Mycologia*, 1923, **15**, 68–88, 1 fig.). Riddle considered these lichens unusually important as providing a list of rock lichens in the W. Indies. The collection was made by Mrs. N. L. Britton and Percy Wilson. Lichens from the Isle of Pines now include 49 genera with 127 species. One genus, *Monoblastia*, with simple spores (Pyrenulaceæ), is new and 14 species, 11 of which grow on rocks. A. L. S.

Cladonia mateocyatha, a New Species, and some Variations in C. Beaumontii.—C. A. ROBBINS (*Rhodora*, 1925, **27**, 49–51). *C. mateocyatha* grows in small clusters, or in large spreading colonies on sandy loam, etc. It somewhat resembles *C. degenerans*, but is distinctly scyphiferous. A. L. S.

Pure Cultures of Lichen Fungi.—CH. KILLIAN and R.-G. WERNER (*Comptes Rendus Acad. Sci.*, 1924, **179**, 1339–42, 10 figs.). The writers selected *Cladonia squamosa* for cultural experiment, and followed germination of the ascospores and development (without gonidia) from day to day. At the end of six weeks minute colonies had been formed, which in section showed radiating filaments at the periphery, and at the centre the beginning of a plectenchyma. A month later a small dome about 1 mm. high had developed, which in section showed a differentiation between cortex and medulla, the latter of loose tissue, the former somewhat dense. In five months the cylinder measured 5·3 mm. in height. The dome remained unchanged, growth being intercalary at the base. A. L. S.

Canadian Lichens.—G. K. MERRILL (*Rep. Canad. Arc. Exp.*, 1913–18, *Ottawa*, 1924, **4**, Part D. Lichens, 3–12.) The lichens were collected from points on the Arctic coast along the 70° parallel. A territory thirty miles inland from Alaska and another region on the Coppermine River were also explored. On the coast rocks, pebbles, old bones, driftwood and tundra formations yielded lichens; elsewhere a few were collected from the dead branches of living trees. Conditions were not favourable to the growth of the larger lichens, but crustaceous forms were well developed and fertile and entirely covered the rocks. Three species only were exclusively Arctic as far as N. America is concerned: *Cetraria chrysantha*, *Polyblastia scotinospora*, and *Verrucaria striatula* f. *dealbata*. All the others found could be duplicated from mountainous regions in America. Merrill remarks that climatic conditions are unfavourable to rapid growth, and species might persist for a hundred years practically unchanged. Two of the rock lichens are pioneers: *Caloplaca miniata*, which prefers smooth stones, and *Rhizocarpon geographicum*, which grows on rough ones. It was observed also that numbers of vagrant apothecia were found mixed with other better developed forms. The list comprises 98 lichens. A. L. S.

New or Misunderstood European Lichens.—A. H. MAGNUSSON (*Meddel. Göteb. Bot. Trädgård*, 1926, **2**, 71–82). The first new species, *Lecanora atlantica*, grew on the sea-shore, Norway, facing north. The second, *Acarospora Muddii*, is from Britain, and was originally collected by W. Mudd at Ayton, Yorkshire. *Acarospora pyrenopsoides*, also new, was found in Greenland and Finland. Critical notes and a minute microscopic study is given of other *Acarosporæ*. A. L. S.

Steronema Chthonoblastes, a Primitive Lichen.—K. R. KUPFFER (*Korrespond. Naturf.-Ver. Riga*, 1924, **58**, 111–22, 1 pl.; see also *Hedwigia*, 1926, **66**, *Beibl.* 8–9). The above plant was described as an alga by Kützing in 1849, and has been several times observed as a pioneer vegetation on bare sand at Danzig and Riga. Recent research by Kupffer has determined that it represents the mycelial stage of a lichen, such as occurs in undeveloped thalli of *Lecidea* or *Biatora*. The algal components are unicellular Protococcaceous cells. As a first colonist of sand it plays an important part in plant succession.

A. L. S.

Culture of the Fungal Symbiont in Xanthoria parietina.—R. G. WERNER (*Bull. Soc. Mycol. France*, 1926, **41**, 385–7, 1 pl.). Werner continues in this paper the work done on *Cladonia squamosa* by himself and Ch. Killian. It has long been proved that the spores of lichens would germinate and form a small body of the nature of a thallus. Werner describes in detail the growth of such a thallus from the spores of *Xanthoria parietina*. Growth was comparatively slow, but in seven months it took the form of a rather massive expansion measuring 1 square centimetre with a height of 7 mm. It was yellow in colour, and even more deeply yellow than the natural lichen. Growth at that stage had become more or less stationary, but the hyphæ were still active, as evidenced by minute buddings. After ten months the culture had slightly increased to 1·4 cm. × 1 cm. Killian notes, as in his culture of *Cladonia squamosa*, the thick walls of the hyphæ.

A. L. S.

Systematic Research on Lichen Parasites and Lichenoid Fungi.—KARL KEISSLER (*Ann. Nat. Hist. Museums, Wien*, 1925, **39**, 194–202.) The author passes in review a number of genera and species that are of somewhat doubtful position or determination. The Mycetozoon *Hymenobolina parasitica* he dismisses as only the well-known *Illosporium roseum*, a parasite also on *Peltigera canina* (evidently a mistake on Keissler's part). *Obryzum* is a lichen genus of somewhat doubtful position, and is more frequently classified among fungi. Keissler classifies the species *Obryzum corniculatum* as *Guignardia corniculatum* Keiss.

Other lichen parasites classified under *Tryblidaria* he places in Steiner's genus *Polyschistes*. The genus *Epiglia* and several species of *Lecidea* are also reviewed. A. L. S.

Goniocysts of the Lichens Genus Moriola Norm.—E. BACHMANN (*Ber. Deutsch. Bot. Ges.*, 1925, **43**, 294–329, 6 figs). Bachmann has made a study of this very obscure and somewhat doubtful genus. It grows on soil or on bark in Scandinavia. Bachmann found the goniocysts as already described; he compares these with the soredia of other lichens. In *Moriola pseudomyces* the hyphæ are brown, which in early stages occur in strands, but as the goniocysts increase in size the hyphæ become transformed into the permeating or cortical tissue. The goniocysts increase in a tangential direction till they are several times as broad as they are high. The mature cortex is composed of a layer of cells, the outer walls of which are brown; the interior of the goniocyst contains about 100 algal cells, which belong to the Cyanophyceæ, and in which no nucleus could be found; Bachmann suggests that more than one type of alga may be present. At first there is a great development of these algæ in number and size on contact with the hyphæ; at a later stage there arises parasitism of the fungus on the alga. Bachmann insists on the symbiotic lichen character of the genus, even though at the end of development a parasitic stage may develop. A. L. S.

Collemaceæ of the Regnell Herbarium.—O. A. N. MALME (*Ark. Bot.*, 1924, **19**, N. 8, 1–28). Malme has determined 5 species of *Collema* and 23 species of *Leptogium* from the material sent to him collected in the neighbourhood of Caldas (Minas Geraes). There is only one rock *Collema* recorded, *C. paraguayense* n. sp., owing to the almost complete absence of lime rocks. Soil species were entirely lacking. Out of the 22 species of *Leptogium* 21 were normal corticolous species. Most frequently they grew in well-lighted evergreen woods on the borders of the forest or on isolated trees in moist situations. Some species, such as *L. marginellum*, *L. tremelloides* and *L. moluccanum*, grew well in deep shade, and occur not infrequently in the dense primeval forests. Strong insolation (and dryness) is very harmful, especially to *Leptogia*. In the deciduous woods of Colonia Russo, *Leptogium phyllocarpum*, *L. tremelloides* and *L. moluccanum* were absent, but species of *Collema* were comparatively abundant. Two Collemas and seven Leptogiums are new. A. L. S.

Vegetation Studies in the Island of Gothland.—G. EINAR DU RIETZ (*Svensk. Vaxtsoc. Sallssk. Handl. Upsala*, 1925, **2**, 1–65, 16 figs.). In this paper of general ecology lichens play a considerable part. Du Rietz has followed the scheme set forth in his great work on the "Principles of Modern Plant Sociology" (1921), in which the detailed examination of small limited areas is followed. Much of the work concerns the ecology of the higher plants, then follows an account of areas of association between these plants and lichens—as, for instance, the *Duriherbosa* Association, which covers much of the rocky soil of the Island; *Festuca ovina*, the dominant plant, is associated in turn with sub-dominants *Cladonia rangiformis*, *Cetraria islandica* and *Cornicularia* *aculeata.* Elsewhere a related association in which *Avena pratensis* and *Sedum* are the dominants instead of *Festuca.* It is only on rocks that pure lichen associations are to be found, and, in Gothland, Du Rietz distinguishes the two great groups of non-halophilous and halophilous, with important variations as to the type of rock, either calcareous or siliceous: the details of many associations are given. Interspersed are numerous observations on the influence of the substratum. On rocks covered by the tide, the *Verrucaria maura* belt developed on any kind of stone, the next higher zone of *Caloplaca marina* was also found to be fairly constant on different rocks; but in the upper regions, and further removed from the direct influence of sea-water, the difference due to the substratum became more marked. He noted also that the lichens on calcareous rocks resembled those on siliceous rocks frequented by birds. He suggests that the similarity may be caused by the presence of lime in the excrement of sea-birds, or in its alkalinity. Other instances are cited as to the influence of sea-water being powerful enough to discount that of the substratum.

A. L. S.

New Contributions to a Knowledge of the Lichen Vegetation of the Buda-Szentendre-Visegrader Gebirges.—GYÖRGY TEMKÓ (*Bot. Kozlemén*, 1925, **22**, 81–104. Hungarian with German Résumé [30–1]). Temko gives a sketch of the country, which lies in a fold of the Donau. There are two groups of mountains and a wide forest region of needle and leaf trees. A list of 250 species is recorded; substrata and localities are given. A. L. S.

Bettws-y-Coed Lichens.—H. H. KNIGHT (*Trans. Brit. Mycol. Soc.*, 1926, **10**, 242–4). A very large number of lichens were collected, many of them necessitating later microscopic examination. They were collected on both sides of the River Conway—in Carnarvon and Denbigh. A few calcareous lichens were found on the mortar of walls. Several species, usually sterile, were found in a fruiting condition. A. L. S.

Mycetozoa.

Mycetozoa found during the Betts-y-Coed Foray.—G. LISTER (*Trans. Brit. Mycol. Soc.*, 1926, **10**, 240–2). The number of species found (37) was a proof of the favourable locality, and that in spite of heavy rains, which tend to dissipate the delicate growths. Nine of the species and one variety were new to Wales. The more interesting species are described: *Cienkowskia reticulata* (new for Wales) in the plasmodium stage was brought in and kept under observation, finally producing branched plasmodiocarps, with crimson pink warts which consist of some waxy substance. A. L. S.

Mycetozoa from Matlock.—W. T. ELLIOTT (*Tom. cit.*, 242). A list of nineteen species collected at Matlock during the Spring Foray, 1924.

A. L. S.

MICROSCOPICAL PHYSICS.

Microscopic Problems.—R. Gans (*Ann. des Physik.*, 1925, **78**, 1). A treatment of fundamentals from the point of view of Maxwell's theory (as far as this will serve), together with approximations. An important section deals with the image through an objective with certain limitations of aperture. Numerous diagrams are appended. F. I. G. R.

Properties of Amethyst Quartz.—C. V. Raman and K. Banerji (*Trans. Opt. Soc.*, 1924–5, **26**, 289). Such a plate is shown to behave as a diffraction grating with change of phase. Considerations of visibility with and without polarizers and analysers are discussed from the point of view of Abbe's theory. F. I. G. R.

Electrical Counter.—K. G. Emeléus (*Proc. Cam. Phil. Soc.*, 1926, **23**, 85). The point of the counter was observed with a microscope, the objective of which was immediately outside a mica window, which gave a method of examining the brush discharges. F. I. G. R.

Shetlands Riebeckite.—F. C. Phillips (*Geol. Mag.*, 1926, Feb., **63**, 72). The paper is concerned with field occurrence, petrography, and a comparative study, together with chemical analysis. Of special interest are a couple of micro-photographs of the Granophyre variety from Grut Wells, Ronas. F. I. G. R.

Geology of Rhobell Fawr.—A. K. Wells (*Quart. Journ. Geol. Soc.*, 1925, **81**, 463). The area in question comprises some 30 square miles in Southern Merioneth. The sequence ranges from Lingula Flags to Bala Mudstones. Micro-photographs are given of the quartz-keratophyre tuff, and of a specimen of Spilites. F. I. G. R.

Spherulitic Siderite.—E. Spenser (*Quart. Journ. Geol. Soc.*, 1925, **81**, 667). Equations are developed for the form of the surface of contact between two interfering spherulites, a matter which promises to throw much light upon the vexed question of their law of growth. A number of plates illustrate spherulites of various forms from India, Portugal and elsewhere. F. I. G. R.

Specific Heat of Rocks.—T. Okaya (*Jap. Journ. Astron. and Geophys.*, 1925, **3**, No. 1). Data for seventy-one different rocks are given, with appropriate petrological descriptions. Chemical composition is the chief factor determining the specific heat, though structure is not without influence. The values for nearly all rocks lie between 0·1 and 0·3. The paper is illustrated by a number of admirable micro-photographs. F. I. G. R.

Magnetite Garnet Rocks.—A. L. Coulson (*Sci. Rep. Australian Antarc. Exp.*, 1925, A, 3, Pt. 5). A description of schists and gneisses collected from the moraines of Cape Denison. In the cordierite well-formed pleochroic haloes are found, and a complete petrological history of the rock specimens is included. F. I. G. R.

NOTICES OF NEW BOOKS.

Practical Photo-micrography. By J. E. Barnard, F.R.S., F.R.M.S., Lecturer in Microscopy, King's College, and Frank V. Welch, F.R.M.S. Second Edition. Pp. 316. Price 18*s*. net. London: Edward Arnold & Co. 1925.

A new edition of this work will be welcomed by all photo-micrographers, it being fourteen years since the first edition was published. As stated by the authors in the preface, there has, however, even after that lapse of time, been no great advance in photo-micrography. Readers will therefore find few alterations in this new edition.

When the writer of this notice read the first edition, now many years ago, he found it very interesting and obviously written by a man who besides being a keen photo-micrographer was also an expert mechanic. These characteristics still strike one on reading this new edition. The remarks on apparatus, whether it be a microscope stand or an arc light, are eminently practical, and such as could only have been written by men who are perfectly acquainted with and have for long used the things themselves.

Under the heading of "Optical Equipment" will be found all that is necessary for the carrying on of photography with the microscope, and will also be found the pleasing evidence that whereas at the date of the first edition one had to depend almost exclusively on Continental manufacturers for the best microscope objectives, that is no longer the case, it being now quite possible to obtain apochromats and dark-ground illuminators made by British manufacturers, which are the equal, and in some cases even the superior, of anything to be found abroad.

Under "Sources of Illumination" there is little change, except that the very useful Nernst lamp has disappeared and in its place we have the Pointolite lamp, which although probably more effective is certainly much more expensive.

Under the heading of "The Photo-micrographic Camera," the most interesting additions are the small cameras which fit on to the upper end of the microscope tube, suitable for the photographing of movable objects, the focussing being done with the help of a viewing telescope. One of these is by E. Leitz and another by Carl Zeiss. Two very beautiful examples of photo-micrographic apparatus, one by E. Leitz and the other by Mr. M. T. Denne, are also illustrated and described.

Under the "Use and Manipulation of the Microscope, General Preliminary Preparations, and Screens, Plates and Exposure" one will find almost all that is necessary for the satisfactory taking of photographs with the microscope.

The first of these chapters (on the "Use and Manipulation of the Microscope") is devoted chiefly to illumination. The use or non-use of a collecting lens, and also whether this lens should be adjusted so as to give parallel rays with an enlarged image of the original source of light on the field, or to give converging rays with an image of the illuminated collecting lens, are all fully discussed. The writer is glad to see that the authors seem to favour the latter arrangement, which is by far the more satisfactory method of illumination in photography with the microscope.

It is a pleasure to see that more space is devoted in this work to exposure than is usually done in books on photo-micrography.

Under the heading of "Some Special Processes" the authors give some useful information on photo-micrography with ultra-violet light, and we are promised some more information on that subject in another work. The methods of the photography of metal surfaces is also described in this chapter at considerable length, as is also the photography of tube and plate-cultures of bacteria, with some rather ingenious suggestions for illumination.

The book ends with some progressive examples of photo-micrographs with particulars as to the conditions under which they were taken. The writer would like to suggest that it would have been a great improvement if in addition to the other details the working aperture had also been given. This has been done in Plate IX, fig. 3. D. J. R.

The Surface-history of the Earth. By Professor John Joly, Sc.D., F.R.S. Pp. 192. Oxford : Clarendon Press. 1925.

Although addressed mainly to the geologist and the geophysicist, this book should make an appeal to workers with the microscope. In discussing such subjects as isostasy, radio-activity, and so on, there is much work which needs the instrument of brass and glass. The author brings into his book an enthusiasm for work in the field which, combined with his deep appreciation of physical science *per se*, makes all that he has to say of the greatest weight to travellers, explorers, and the countless hosts of people who delight in nature on the grand scale.

A number of micro-photographs of haloes in mica, and one of such inclusions (of unknown origin) in the mica of Ytterby, will be welcomed by the petrologist, as well as an admirable glossary of terms.

A real live book on physical geology is a delight. It remains only to congratulate once more the Clarendon Press upon their very dignified setting of the work. F. I. G. R.

Coleoptères de la Manche. By M. le Chanoine Oct. Pasquet. 1913–1923. 332 pp. Published by La Société Nationale des Sciences Naturelles de Cherbourg.

Les Potentielités des Régénérats chez Salamandra Maculosa (Croissance et Differenciation). By Pierre de Giorgi. 1924. 52 pp., 1 plate and 6 text-figures. Published by Imprimerie Albert Kundig, 4 Rue du Vieux-Collége, Geneva.

Recherches sur l'Histogenèse et la Régénération chez les Batraciens Anoures (Corde dorsale et tègumeents). By André Naville. 1924. Pp. 235–344, 26 text-figures. Published by Imprimerie H. Vaillant-Carmanne, 4 Place Saint-Michel, Liége.

PROCEEDINGS OF THE SOCIETY.

AN ORDINARY MEETING

OF THE SOCIETY WAS HELD AT 20 HANOVER SQUARE, W.1, ON WEDNESDAY, DECEMBER 16TH, 1925, MR. A. CHASTON CHAPMAN, PRESIDENT, IN THE CHAIR.

The Minutes of the preceding Meeting were read, confirmed, and signed by the President.

The nomination papers were read of two Candidates for Fellowship.

New Fellows.—The following were elected Ordinary Fellows of the Society:—

Mr. Frederic P. Carrel.
Mr. Noel John Clarke.
Mr. John Mansell, B.Sc., F.C.S., M.P.S.
Mr. Frederick W. Pilditch.
Mr. H. Cameron Wright, M S.R.

Donations were reported from :—

M. Paul Lechevalier—
  Faune de France : —
    " Hyménoptères Vespiformes, 1 " (Berland).
    " Diptères " (Kieffer).
The Marine Biological Association : —
  " The Dinoflagellates of Northern Seas."

A hearty vote of thanks was accorded to the donors.

The List of Fellows nominated for Election in January as Officers and Members of the Council was read.

The following papers were read and discussed :—

Dr. W. Cramer, Ph.D., D.Sc., M.R.C.S., L.R.C.P., and Dr. R. J. Ludford, Ph.D., B.Sc., F.R.M S. (from the Laboratories of the Imperial Cancer Research Fund) —
  " Bile Canaliculi and the Golgi Apparatus in Hepatic Cells."

Dr. C. Da Fano, M.D., L.D., F.R.M.S.—
"Recent Methods for the Study of the Neuroglia."
Miss A. Lorrain Smith, F.L.S.—
"Some Lichen Dyes."
Mr. F. I. G. Rawlins, M.R.I., F.R.M.S.—
"The Theory of Dimensions in Microscopy."

Hearty votes of thanks were accorded to the authors of the above papers.

The business proceedings then terminated.

A SPECIAL GENERAL MEETING

OF THE SOCIETY WAS HELD AT 20 HANOVER SQUARE, W.1, ON WEDNESDAY, JANUARY 20TH, 1926, MR. A. CHASTON CHAPMAN, PRESIDENT, IN THE CHAIR.

It was proposed from the **Chair** and seconded by **Mr. Hill**:—

That the Society's By-Laws be altered in the following manner:—

That in the fourth line of By-Law 27 the word "Publications" be deleted and the word "Journal" be inserted in its place.

The motion was carried.

THE ANNUAL MEETING

OF THE SOCIETY WAS HELD AT 20 HANOVER SQUARE, W.1, ON WEDNESDAY, JANUARY 20TH, 1926, MR. A. CHASTON CHAPMAN, PRESIDENT, IN THE CHAIR.

The Minutes of the preceding Meeting were read, confirmed, and signed by the President.

New Fellows.—The following were elected Ordinary Fellows of the Society:—

Mr. Frederick Brown.
Mr. Jesse Brooks Titchener.

A Donation was reported from :—

Messrs. E. Arnold and Co.—

"Practical Photo-Micrography." (Barnard and Welch.)

A hearty vote of thanks was accorded to the donors.

THE ANNUAL REPORT of the Council for the year 1925 was read as follows :—

FELLOWS.

During the year 41 Ordinary Fellows and 1 Honorary Fellow, Dr. Marshall D. Ewell, have been elected. Notifications of the deaths of 10 Ordinary Fellows have been received. Fifteen Fellows have resigned, 20 have been removed from the Roll, and 3 have been reinstated.

The deaths reported were those of :—

Dr. Charles Adams. Elected 1893.
Mr. James Adams. Elected 1893.
Mr. Charles Bailey. Elected 1894.
Mr. W. J. Dibdin. Elected 1904.
Mr. Joseph Lambert. Elected 1915.
Mr. W. J. Marshall. Elected 1890.
Mr. P. Moreland. Elected 1851.
Mr. Thomas H. Powell. Elected 1880.
Mr. J. A. Robertson. Elected 1908.
Dr. C. F. Sonntag. Elected 1920.

JOURNAL.

The progress in the circulation of the Society's Journal has been well maintained, and there is now a greater demand than ever for copies from Scientific Institutions all over the world.

LIBRARY.

During the year 152 volumes have been borrowed from the Library by Fellows of the Society.

Donations for the Library have been received from -Trustees of the British Museum, M. Gaston Doin, Professor S. H. Gage, Messrs. G. G. Harrop and Co., Ltd., Messrs. Heffer & Sons, M. Paul Lechevalier, and The Marine Biological Association.

Special thanks are due to Mr. R. Paulson for his services as Librarian during the past year. Mr. Paulson has been fortunate in enlisting the valuable help of Mr. E. H. Ellis and of Mr. A. W. Sheppard in the task of the rearrangement of the shelves, and the preparation of accumulated literature which the Council decided should be disposed of.

It is proposed to sell a number of the bound sets of volumes of various Journals, and particulars of the same will be circulated among the Fellows.

INSTRUMENTS AND APPARATUS.

During the year there have been two donations to the Society's collection of Instruments and Apparatus; these are :—

A special Universal type of Dissecting Microscope designed by and made for Professor A. Gandolfi Hornyold, and presented to the Society by him.

An early Powell and Lealand Objective, complete with Lieberkuhn, presented by Mr. W. J. Ireland.

The preparation of the catalogue has continued. This is now in the press, but printing delays have postponed the appearance of Part I.

THE SLIDE CABINET.

The Curator reports that the Cabinet is now available to Fellows who wish to borrow slides.

There still remain to be properly examined and reported upon a Diatom Collection, a very large collection of slides (many unnamed and duplicates) in the Norman Thomas Collection of Radiolaria, and a large collection of Rotifera and Tardigrada, presented during the year by Mrs. M. N. Murray.

These four separate groups of slides require careful examination, sorting, and final classification. The Curator will be pleased to hear from any Fellow who has the time and special knowledge to assist in, or to undertake, the work required.

Mr. David Bryce is at present working on the Rotifera, and the best thanks of the Society are due to him.

MEETINGS.

The Ordinary Meetings during the year have been well attended, and the Papers submitted have been of great interest.

The Biological Section has well maintained its reputation, as will be seen from the Report to be read this evening The sincere thanks of the Council and of the Society are due to Professor R. Ruggles Gates, who has again acted as Secretary to this Section.

The Industrial Applications Section has held a number of important meetings dealing with Microscopical Research in the Dairying, Textile, Timber, Agricultural and Paper Industries. The presence of the following gentlemen as Chairmen of Meetings of the Section has been greatly appreciated :—

Dr. Arthur W. Crossley, C.M.G., C.B.E., D.Sc., Ph.D., F.R.S.
Sir David Prain, C.M.G., F.R.S.
Sir John Russell, O.B.E., D.Sc., F.R.S.
Professor R. Stenhouse Williams, M.B., B.Sc.

The importance of the work of this Section was seen during the proceedings of the Conference at Sheffield, and the Society is greatly indebted to the labours of the Honorary Officers of the Section—Dr. Tierney, Chairman, and Messrs. W. E. Watson Baker and C. F. Hill, Secretaries.

CONFERENCE AT SHEFFIELD.

The Conference at Sheffield was the outstanding event in the activities of the Society during the year. For the first time in the history of the Society it was decided to visit one of the Provincial Industrial Centres, and the experience gained proved the wisdom of the innovation.

The Municipality, the University Authorities, and the local firms extended the heartiest welcome and assistance to the Fellows who were able to attend.

The thanks of the Council have been accorded to the Lord Mayor and Lady Mayoress (Alderman and Mrs. A. J. Bailey), the Vice-Chancellor of the University (Sir Henry Hadow, C.B.E.), the Master Cutler (Mr. W. W. Wood, Jun.), the Members of the Local Committee (Hon. Secretary, Mr. E. J. Thackeray), and the Firms who kindly invited the Members and Delegates of the Conference to visit their works.

The year 1925 has been an eventful one, and has been marked by steady progress. Your Council has every confidence that this progress will be continued and the usefulness of the Society increased during the coming year.

Mr. Maxwell moved, and **Mr. Bryce** seconded: "That the Annual Report be received and adopted." This was carried unanimously.

Mr. Richardson moved, and **Mr. Wycherley** seconded: "That a very hearty vote of thanks be tendered to the Honorary Officers and Members of the Council for their services to the Society during the past year."

The resolution was carried unanimously.

Mr. Barnard responded on behalf of the Council.

The Report of the Biological Section, read by **Professor R. Ruggles Gates**, was received and adopted (see p. 88).

The President appointed Mr. Taverner and Mr. Wycherley as Scrutineers, and afterwards announced the result of the ballot for the election of Officers and Council for the ensuing year as follows:—

President.—James A. Murray, M.D., F.R.S.

Vice-Presidents.—A. Chaston Chapman, F.R.S., F.I.C., F.C.S.; M. T. Denne, O.B.E.; R. J. Ludford, Ph.D., B.Sc., F.R.H.S.; The Hon. Sir Charles Parsons, K.C.B., M.A., LL.D., D.Sc., F.R.S.

Treasurer.—Cyril F. Hill, M.Inst.M.M., A.Inst.P.

Secretaries.—Joseph E. Barnard, F.R.S., F.Inst.P.; Clarence Tierney, D.Sc., F.L.S.

Ordinary Members of Council.—S. C. Akehurst; E. W. Bowell, M.A., M.R.C.S., L.R.C.P.; Rev. Canon G. R. Bullock-Webster; R. S. Clay, B.A., D.Sc., F.Inst.P., F.Op.S.; C. Da Fano, M.D., L.D.; E. H. Ellis; R. Ruggles Gates, Ph.D., F.L.S.; J. W. Ogilvy; A. S. Parkes, B.A., Ph.D.; A. Piney, M.B., Ch.B., M.R.C.P., M.R.C.S.; E. A. Robins; Harold Wrighton, B.Met.

Librarian.—Robert Paulson, F.L.S.

Editor.—J. W. H. Eyre, M.D., M.S., F.R.S.Edin.

Curator of Instruments.—W. E. Watson Baker, A.Inst.P.

Curator of Slides.—E. J. Sheppard.

Honorary Solicitor.—T. H. Hiscott.

A vote of thanks was accorded to the Scrutineers.

Mr. A. Chaston Chapman, F.R.S., F.I.C., F.C.S., P.R.M.S., then delivered the Presidential Address, "The Fungi Imperfecti, and a Further Plea for an Institute of Industrial Micro-Biology."

Dr. James A. Murray, the new President, was then inducted to the Chair, and returned thanks for his election.

Mr. Scourfield moved: "That the best thanks of this meeting be accorded to Mr. Chaston Chapman for his Presidential Address, and that he be asked to allow it to be printed in the Journal of the Society."

Mr. E. J. Sheppard seconded the proposal, which was carried by acclamation.

Mr. Chaston Chapman responded.

The business proceedings then terminated.

AN ORDINARY MEETING

OF THE SOCIETY WAS HELD AT 20 HANOVER SQUARE, W.1, ON WEDNESDAY, FEBRUARY 17TH, 1926, DR. JAMES A. MURRAY, PRESIDENT, IN THE CHAIR.

The Minutes of the Special General Meeting and the Annual Meeting held on January 20th were read, confirmed, and signed by the President.

The nomination paper was read of one Candidate for Fellowship.

The death was reported of the following Honorary Fellow of the Society:—

Signor Camillo Golgi. Elected Hon. Fellow 1895.

The following resolution was moved by the President, and carried by the Fellows present standing in silence in their places:—

> "That this Society records its sense of the profound loss to European Science in the death of its Honorary Fellow Professor Camillo Golgi, Senator of the Italian Kingdom."

The following papers were read and discussed :—

Mr. F. Haynes, B.A.—

"A Note on a Rapid Method of Staining in Heidenhain's Hæmatoxylin."

"A Note on an Improved Method of Preparation of Weigert's Elastin Stain."

Dr. A. Piney, M.B., Ch.B., M.R.C.P., M.R.C.S., F.R.M.S.—

"The Principles of Hæmatological Differentiation."

Dr. R. S. Clay, B.A., D.Sc., F.R.M.S., and Mr. T. H. Court—

"The Wilson Microscopes."

Hearty votes of thanks were accorded to the authors of the above papers.

The business proceedings then terminated.

ANNUAL REPORT OF THE HON. SECRETARY, BIOLOGICAL SECTION, ROYAL MICROSCOPICAL SOCIETY.

The last session completed the seventeenth year of the activities of the Biological Section. The year was a very successful one, the meetings were well attended, and much interest was shown in the work of the Section. The method was adopted of having a number of short demonstrations at each meeting, and these frequently gave rise to lively informal discussions.

Among the matters of particular interest which came before the Section may be mentioned the demonstration by Mr. S. C. Akehurst of a trumpet-shaped collar around the cilia in a form of Eudorina; exhibits showing Mitochondria and nuclear extrusions in various animal tissues, and Golgi apparatus in developing neurones, by Dr. R. J. Ludford; a preparation of the spermatheca of an earthworm, showing penetration of the surrounding cells by spermatozoa, by Mr. M. T. Denne; a transverse section of the gravid uterus of *Xerus capensis*, by Dr. A. Subba Rau; and a paper on the accessory air-breathing chambers in certain Indian fishes (Ophiocephalidæ) by Mr. B. K. Das. Dr. J. A. Murray, F.R.S., demonstrated a method of staining elastic fibres, and contributed various other notes on staining and methods with Diatoms, Rotifers and other organisms. Professor Gates gave an account of the relation between the nucleolus and the spireme in plant cells.

The April meeting was devoted to a Symposium on Symbiosis, to which the following made contributions, accompanied by a demonstration:—Dr. M. C. Rayner, Obligate symbiosis in Ericaceæ; Mr. R. Paulson, Mycorrhiza; Mr. E. H. Ellis, Mycorrhiza in Orchids and in the Moss Buxbaumia; Mr. J. Wilson, *Convoluta roscoffensis*; Professor Gates, Euglena and purple bacteria.

The Section is much indebted to Messrs. Watson and Sons, Ltd. for lending microscopes for use in the demonstrations at the various meetings.

On April 25 the Section visited the Pharmaceutical Society in Bloomsbury Square. They were received by Professor Greenish, who showed them the laboratories and the museum, where a great many interesting drugs and plant products were examined and discussed. The library was also visited.

On June 13 a visit was made to the Chelsea Physic Garden. Mr. Hales conducted the members through the greenhouses, where many exotic plants in excellent cultivation were examined and their peculiarities pointed out. Afterwards the order beds were visited, and many interesting plants observed.

R. Ruggles Gates, *Hon. Secretary.*

JOURNAL
OF THE
ROYAL MICROSCOPICAL SOCIETY.

JUNE, 1926.

TRANSACTIONS OF THE SOCIETY.

VI.—SOME RECENT METHODS FOR THE STUDY OF NEUROGLIA.

By C. Da Fano, M.D., F.L.S., F.R.M.S.,
Reader in Histology, King's College University of London

(*Read December 16, 1925.*)

Four Plates.

I. Introduction.

The present paper was written in order to meet the persistent demand that the methods elaborated by S. Ramón y Cajal and P. Del Río-Hortega for the study of neuroglia should be published in English in a British Journal. As a matter of fact nothing of this sort exists apart from the now incomplete review of Bailey and Hiller (*3*)* and the additions which the writer was able to make to the last edition of the Microtomist's Vade-Mecum (*12*).

The methods about to be described were taken from the original sources, but in describing them due weight has been given to personal experience gained chiefly through a short stay in Del Río-Hortega's laboratory in Madrid. I gladly take this opportunity to express my great appreciation of the facilities which he gave me on that occasion, and to thank Professor Ramón y Cajal for his kindness. Both of them presented me with some extremely valuable specimens, two of which have been used for drawing figs. 7 and 8.

It is important to point out that the term "neuroglia," when used without any further specification, is taken to mean *the whole of the interstitial tissue which is proper to the central nervous organs of vertebrates, and which obviously is not connective or reticular tissue.*

Following the generally accepted custom, the terms "formalin" and "formol" are used to indicate the commercial 40 p.c. solution of formaldehyde as if it were a true chemical reagent. As a rule it should be shaken with some calcium carbonate, and after decantation, shaken again with a small quantity of animal charcoal and filtered through paper.

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* The italic figures within brackets refer to References at the end of the paper.

Owing to the great softness of the Madrid water, not much attention is paid in Del Río-Hortega's laboratory to the distillation of water, but in this country it should be distilled and, for making up silver solutions, redistilled over potassium permanganate, as suggested in previous papers (*10*, *11*).

Purity of the reagents is essential to the methods about to be described.—With a few exceptions they are all based on the fixation of nerve tissue in the following—

Fixing Solution (Formol-Bromide).

Formalin . . .	15 c cm.
Distilled water .	85 c.cm.
Ammonium bromide . .	2 gms.

This can be prepared beforehand and keeps unaltered for months. It will be spoken of as the "formol-bromide solution" or, briefly, "formol-bromide." It gives rise in tissues preserved in it for months to a crystalline precipitate for the dissolution of which no method has so far been devised.

II. METHODS FOR THE DEMONSTRATION OF PROTOPLASMIC AND FIBROUS NEUROGLIA (MACROGLIA).

The term "protoplasmic neuroglia" is here used in the sense attributed to it mainly by Cajal and his pupils—viz. of neuroglia cells provided with protoplasmic processes only. The term "fibrous neuroglia" is taken to mean neuroglia cells with differentiated fibres or fibrils as well as neuroglia fibres as they appear in specimens stained by the Weigert method or any one of its modifications. The term "macroglia" has been recently proposed by Cajal (*9*) to indicate briefly these two kinds of neuroglia.

(1) *Cajal's Gold Chloride and Sublimate Method* (*4*, *6*, *7*, *8*).—Thin slices of fresh tissue are fixed in formol-bromide and cut by freezing. The sections, 25–30 μ thick, are collected in distilled water to which a few drops either of formalin or ammonia are added. After washing twice in distilled water, batches of 4–6 sections are each transferred into the gold chloride and sublimate mixture to be prepared as follows:—

Pour into a porcelain capsule 50 c.cm. of distilled water and 10 c.cm. of a 1 p c. solution of gold chloride of the brown variety (viz. non-containing free HCl). Add 0·5–0·8 gm. of *crystallized* corrosive sublimate and dissolve it in the gold chloride solution by gentle heat. Filter into either a small porcelain dish with flat bottom or a Petri dish to the external surface of which a piece of filter-paper has been stuck.

The sections are flattened to the bottom of the vessel and placed in the dark. After 4–6 hours at 18°–20° C. the sections will have assumed an intense purple-red colour, when they can be washed in distilled water and placed for about 10 minutes in Cajal's

FIXING BATH.

5 p.c. sodium hyposulphite .	40 c.cm.
95 p.c. alcohol . . .	10 c.cm.

After washing in 50–60 p.c. alcohol the sections are lifted on slides, blotted with filter-paper, dehydrated with absolute alcohol, cleared first with origanum oil and then with xylol, and mounted in Canada balsam. Instead of absolute alcohol and origanum oil, one may use 95 p.c. alcohol, followed by Del Río-Hortega's mixture of 80 parts of xylol, 10 parts of carbolic acid cryst. and 10 parts of creosote.

The reaction is greatly influenced by temperature. At 14° to 17° C., 8–10 hours are necessary to obtain good impregnations, while at temperatures below 14° C. it is difficult to obtain any reaction at all. Temperatures oscillating between 20° and 26° C. are recommended for the cortex cerebelli, the brain stem and the spinal cord, while a temperature of about 30° C. is useful for the central nervous system of birds, reptiles and fishes. To make sure of constant temperatures one must have resort to incubators. In Del Río-Hortega's laboratory it has, however, been found practical to place the dish containing the sections and the impregnating fluid on a sheet of asbestos supported by a tripod under which an ordinary electric lamp is lit. The process is carried out in a dark corner of the laboratory and easily watched and stopped when necessary.

Ceteris paribus results vary according to the length of the fixation period. As a rule the tissue begins to be ripe for cutting from the third day and continues to be in a favourable state for another two or three weeks, though good impregnations may be obtained after one or even two months of hardening. The capacity for taking the gold disappears from the protoplasmic and then from the fibrous neuroglia.

This method is suitable for the study of the entire macroglia, but particularly for the demonstration of the protoplasmic neuroglia cells of the human cerebral cortex. In specimens from adult subjects the cytoplasm and processes of these cells appear frequently beset with vacuoles which, according to Cajal, are occupied by unstained gliosomes (see page 98). However, in preparations from the cerebral cortex of new-born infants and babies of some months, the vacuoles are often absent, and the delicate cytoplasm and its processes have a finely granular appearance, well shown in fig. 1.

(2) *Del Río-Hortega's Carbonate of Silver Method for Macroglia* (*14*, *15*).—The material is fixed in formol-bromide from two to six weeks. The sections, 15–20μ thick, are made by freezing, and collected in distilled water alkalized with ammonia. After washing in distilled water, some of them are transferred into the impregnating fluid to be prepared thus :—

SILVER BATH (Del Río-Hortega) for Macroglia.

20 c.cm. of a 10 p.c. solution of silver nitrate are precipitated with an equal volume of a saturated solution of lithium carbonate. The supernatant fluid is poured off and the precipitate first washed with distilled water and then just dissolved with ammonia. After bringing it up to a total of 100 c.cm. the fluid is filtered into a dark brown or blue bottle. If not exposed to direct sunlight it keeps unaltered for months. At the moment of use a small crystallizer is filled with this fluid almost to the brim, so that when covered with a watch-glass a bubble of air should remain between it and the fluid. The air bubble is subsequently useful to agitate the sections. Before passing the sections into the impregnating bath, 2–4 drops of pyridine are added to it.

The covered crystallizer, with the "pyridinated silver carbonate solution" and the sections, is now placed on a sheet of asbestos supported by a tripod under which a spirit lamp is lit. In this way the temperature of the bath is brought to 50–55° C., and in 5–10 minutes, during which the sections are almost continuously moved about, the fluid assumes a greyish-yellow tinge, and the sections a tobacco-brown colour. They are then passed, all at the same time, into distilled water, and then, one by one, into a formalin solution, the strength of which may vary from 2 to 10 p.c., or even 20 p.c., according to the nature of the material in hand, time of fixation, thickness of the sections, etc. Definite rules on this point cannot be given, while the proper strength of the reducing fluid can be easily found out by trials. Reduction takes place almost immediately, and after washing in distilled water the sections are toned in a 1 : 500 solution of gold chloride, first at room temperature, and then on the usual sheet of asbestos over a flame. Wash, fix with 5 p.c. sodium hyposulphite, wash again, dehydrate with alcohols of increasing strength, clear with the mixture of xylol, carbolic acid and creosote referred to above, blot with filter-paper, and mount in balsam.

This method stains both the protoplasmic and fibrous neuroglia,

EXPLANATION OF PLATE VII.

Fig. 1.—Protoplasmic neuroglia cells of the grey matter of the cerebral cortex of a two years' old child.

Cajal's gold chloride and sublimate method. × 630.

Fig. 2.—Macroglia cells of the grey substance of the cerebral cortex of an old subject.

Del Río-Hortega's carbonate of silver method. × 940.

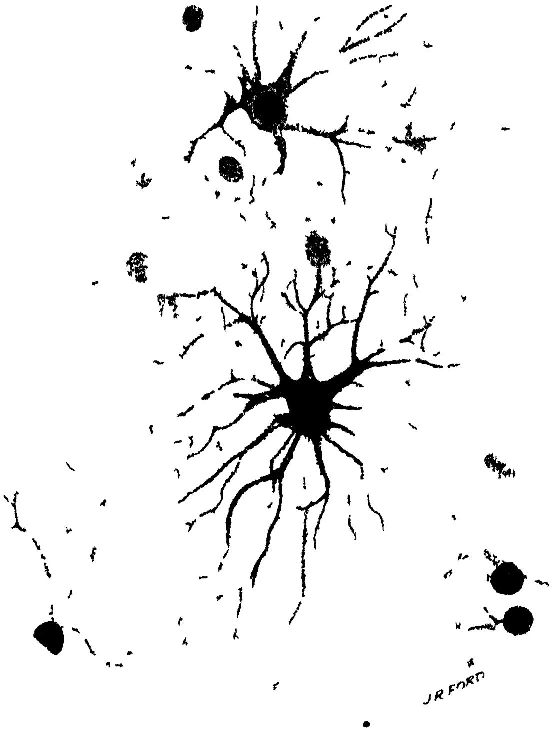
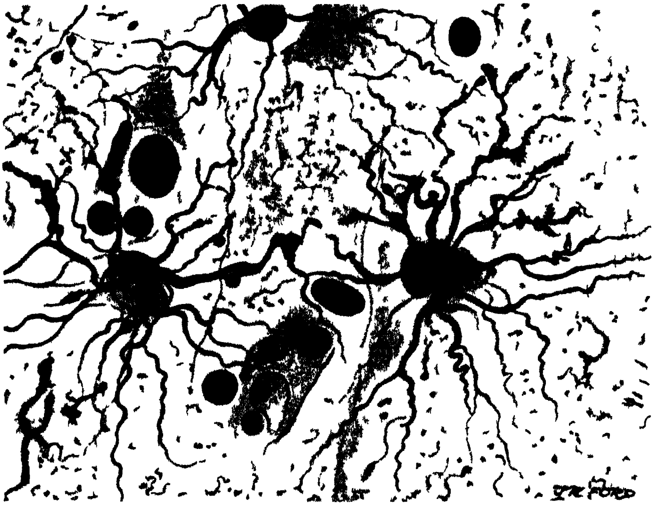


Fig 1



results varying according to the length of the fixation period. If applied to the study of the macroglia of the cerebral cortex of old subjects, it impregnates cells in the grey substance, the processes of which are in part fibrous and in part protoplasmic. As shown by fig. 2, the latter may exhibit a peculiar coarseness, and frequently terminate with irregularly shaped enlargements. The unrivalled completeness and delicacy of successful specimens obtained by this method is illustrated also by fig. 3, showing fibrous neuroglia of the white substance of the cerebral cortex of the adult cat.

(3) *Del Río-Hortega's Fourth Variant of Achúcarro's Tannin Method for Protoplasmic Neuroglia (14).*—The importance of this method and of the following one is due to this, that they can be carried out on nerve tissue preserved for some time in formalin. The *modus operandi* is as follows: Frozen sections are collected in distilled water alkalized with ammonia, washed in distilled water, and treated for 5–10 minutes at about 50° C. with a mixture of 1 grm. of ammonium bromide, 3 grm. of acidum tannicum puriss. leviss. and 100 c.cm. of distilled water. Before the solution cools, transfer the sections into ammoniacal water until they regain their transparency and flexibility. Pass them successively into three small glass dishes each containing 1 c.cm. of Bielschowsky's silver oxide solution* and 10 c.cm. of distilled water. As soon as they have taken a brownish colour, wash them quickly in distilled water and reduce them in 20 p.c. formalin. Tone, fix, dehydrate, clear and mount as by the carbonate of silver method for macroglia.

(4) *Del Río-Hortega's First Variant of Achúcarro's Tannin Method for Fibrous Neuroglia (13).*—Besides neuroglia cells, this method impregnates also elastic membranes, connective tissue cells, nuclei and centrosomes. Frozen sections from material preserved in formalin even for a long time are mordanted for 5 minutes in a 3 p.c. solution of acidum tannicum puriss. leviss. in water kept at 50–55° C., and washed in distilled water alkalized with ammonia. They are then impregnated in the dilute silver oxide solution of Bielschowsky as by method 3, and after washing in distilled water, transferred *directly* into 1 : 500 gold chloride kept for about 20 minutes at 40–50° C. Wash, fix, dehydrate and mount as by the previous methods.

The Ingleby Modification (26) for the demonstration of the perivascular foot of fibrous neuroglia cells is a combination of methods 2, 3 and 4. Frozen sections from formol-bromide material are mordanted for 5–10 minutes with 10 p.c. tannic acid at 50° C., impregnated with 1 : 10 Bielschowsky's silver oxide solution, and reduced in 20 p.c. formalin. Tone, fix, and mount as above.

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* The silver oxide solution of Bielschowsky can be prepared either at the moment of use, as suggested by Da Fano (*11*), or by the following method generally employed in Cajal's and Del Río-Hortega's laboratories: 10 c.cm. of a 10 p.c. solution of $AgNO_3$ are precipitated with 12 drops of 40 p.c. NaOH; the precipitate is washed five or six times with distilled water. After adding 60–70 c.cm. of distilled water, the precipitate is dissolved by means of NH_3, an excess of which should be carefully avoided. If filtered into a dark bottle the solution keeps unaltered for some time.

(5) *Cajal's Modification of the Bielschowsky Method* (7).—This is a combination of the Bielschowsky and Del Río-Hortega methods, and consists essentially of the use of Bielschowsky's silver oxide instead of Del Río-Hortega's silver carbonate solution. Frozen sections from formol-bromide material are collected in the fixing fluid, and then mordanted for 4–8 hours at 37° C. in a mixture of 50 c.cm. of distilled water, 6 c.cm. of formalin and 3 grm. of ammonium bromide. After a quick wash they are transferred into the impregnating bath consisting of 15 c.cm. of distilled water, 3–5 c.cm. of Bielschowsky's silver oxide solution and 2–4 drops of pyridine. After about 5 minutes the crystallizer, containing this fluid and the sections, is placed over a flame and warmed until the sections are tobacco-brown in colour. One by one they are then quickly washed in distilled water and passed into 5 p.c. formalin. Reduction is complete within a few minutes, and there only remains to wash, tone, fix and mount the sections in the usual way.

As shown by fig. 5 the method stains intensely the fibrous neuroglia of the spinal cord, brain, stem and white substance of the cerebral cortex of man and certain mammals. The protoplasmic neuroglia is less easily impregnated, though, in Cajal's opinion, excellent specimens can be obtained if fixation in formol-bromide does not exceed 20 days, mordanting is prolonged to about 12 hours, and the impregnating fluid contains less pyridine (1 2 drops). For the reduction 10 or 20 p.c. formalin may be used.

Cajal (*9*) has quite recently suggested two somewhat different formulæ for the preparation of the mordanting and impregnating fluids respectively. The former should consist of 70 c.cm. of distilled water, 30 c.cm. of formalin and 3 grm. of ammonium bromide; the latter should be prepared by taking 10 c.cm. of silver oxide solution, 10–12 c.cm. of distilled water, and 7–10 drops of pyridine.

EXPLANATION OF PLATE VIII.

Fig. 3.—Fibrous neuroglia of the white substance of the cerebral cortex of the cat.

Del Río-Hortega's carbonate of silver method. × 675.

Fig. 4.—Microglia cells of the stratum radiatum of the hippocampus major of the rabbit.

Del Río-Hortega's carbonate of silver method. × 470.

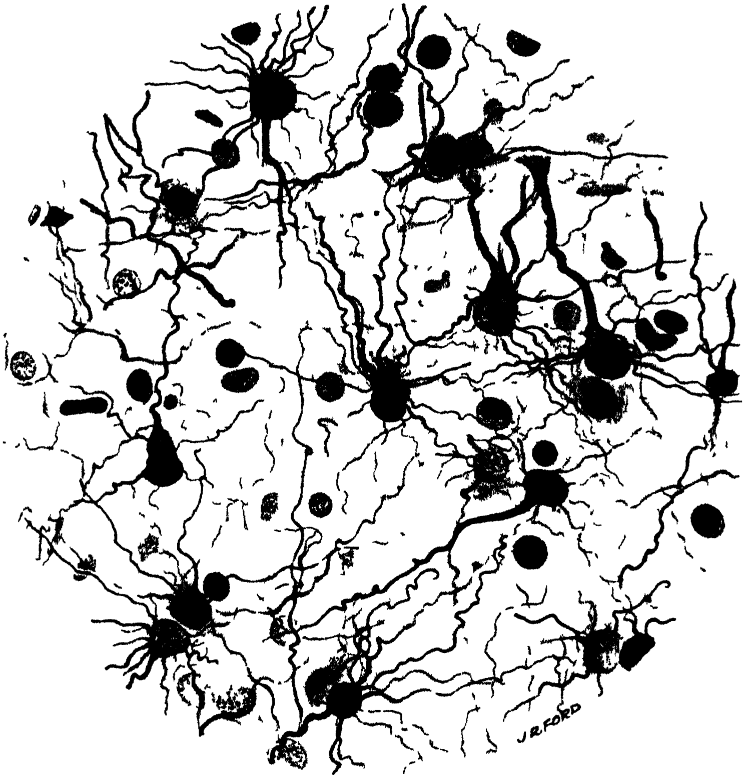
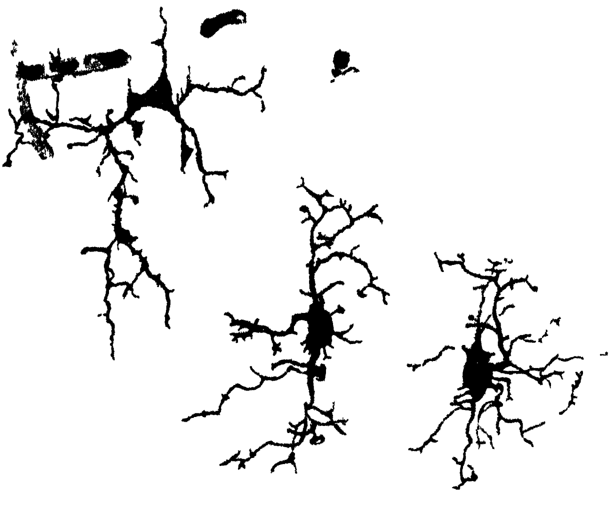


Fig. 3



III. METHODS FOR THE DEMONSTRATION OF THE MICROGLIA (DEL RÍO-HORTEGA'S CELLS).

The methods to which reference has been made leave unstained a considerable number of cells, the existence of which was recognized by Cajal by this negative feature. Being uncertain as to their nature and significance he termed them "adendritic corpuscles" or the "third element." It is now generally admitted that they correspond to cells which were described under various names by Nissl (neuroglia cells without expansions), Bonome (indifferent cells), Schafer (naked nuclei), Eisath (round cells), Rosenthal (præ-amœboid cells) and others. However, full credit must be given to Del Río-Hortega for having shown that Cajal's third category of elements includes two entirely different groups: the oligodendroglia and the microglia. The oligodendroglia consists of the cells which were discovered by W. F. Robertson (*33–34*) by his platinum method, and termed by him "mesoglia cells," a denomination which should be dropped, since according to Del Río-Hortega, nothing justifies the assumption that they have a mesodermal origin. The microglia was first described by Del Río-Hortega, who showed that it consists of cells provided with a small irregularly shaped or elongated nucleus and highly characteristic cytoplasmic expansions. The nucleus generally contains a considerable amount of chromatin, while the little developed cytoplasm soon continues into a variable number of processes, which sub-divide and give rise to secondary branches frequently ending into peculiar short spines or bunches of spines (figs. 4 and 6). In Del Río-Hortega's opinion, microglia cells have a mesodermal origin, and under pathological conditions may become transformed into either rod-cells (Nissl) or reticular cells endowed with migratory and phagocytic properties, and similar to, if not identical with, the so-called scavenger (granulo-adipose) cells.

(1) *Del Río-Hortega's Carbonate of Silver Method for Microglia* (*16, 17 and 19*).—Fresh tissue should be fixed in formol-bromide from 1 to 4 days, according to the temperature of the laboratory. The pieces are then trimmed and placed in a crystallizer with some fresh fixing fluid and warmed for 10 or 15 minutes up to 50–55° C. either in an incubator or over a flame. Sections are made by freezing and collected in ammoniacal water. After washing in distilled water they are transferred into the following fluid which can be prepared beforehand and keeps unaltered for some time if preserved in a dark bottle :—

SILVER BATH (Del Río-Hortega) for Microglia.

10 p.c. solution of silver nitrate	5 c.cm.
5 p.c. solution of sodium carbonate	20 c.cm.

Ammonia, drop by drop, enough to dissolve the precipitate.
Distilled water to a total of 45–75 c.cm.

As a rule the sections are not washed, but passed one by one directly into a 1 or 2 p.c. solution of formalin, *which may be prepared with tap-water*, as recommended for the Bielschowsky method. It should be poured into a relatively large Petri dish, and as soon as a section is placed in it, one should agitate it by blowing across the surface. When all sections are reduced, they are washed in distilled water and toned at room temperature with 1 : 600 gold chloride. Fix with 5 p.c. sodium hyposulphite, wash, dehydrate and clear on the slide with the mixture of xylol, carbolic acid and creosote to which reference has been made; blot with filter-paper and mount in balsam.

The method succeeds almost always in summer, but has failed in the hands of the writer in winter, no advantage having been found in warming the sections either in the fixing fluid or in the silver carbonate solution.

(2) *Cajal's Method* (*9*).—According to Cajal, his modification of the Bielschowsky method (see page 94) can be successfully used also for the demonstration of the microglia, particularly of the human cerebral cortex, if the sections are warmed in the impregnating fluid only enough to impart to them a brownish colour, and if toning with gold chloride is stopped as soon as the sections have assumed a slightly purple-grey colour.

IV. METHODS FOR THE DEMONSTRATION OF THE OLIGODENDROGLIA (ROBERTSON'S CELLS.)

As shown by fig. 7 the nuclei of these cells are, as a rule, roundish or slightly oval and somewhat larger than those of the microglia cells. The cytoplasm is frequently more developed on one side of the nucleus and provided with a small number of extremely delicate processes. These cells are very difficult to stain, and a proper selective method for their demonstration can hardly be said to exist. The Robertson platinum impregnation (*33*) is very seldom successful, and is practically obsolete; even Del Río-Hortega, and more recently Penfield, have had resort to modifications of Del Río-Hortega's carbonate of silver method for the microglia. These are as follows:—

(*1*) *Del Río-Hortega's Modified Carbonate of Silver Method* (*18*).—The tissue should be fixed in formol-bromide for 12–48 hours.

EXPLANATION OF PLATE IX.

Fig. 5.—**Fibrous neuroglia of the white substance of the spinal cord (longitudinal section) of the rabbit.**

Cajal's modification of the Bielschowsky method. × 605.

Fig. 6.—**A typical microglia cell of the grey substance of the cerebral cortex of the rabbit.**

Del Río-Hortega's carbonate of silver method. × 950.

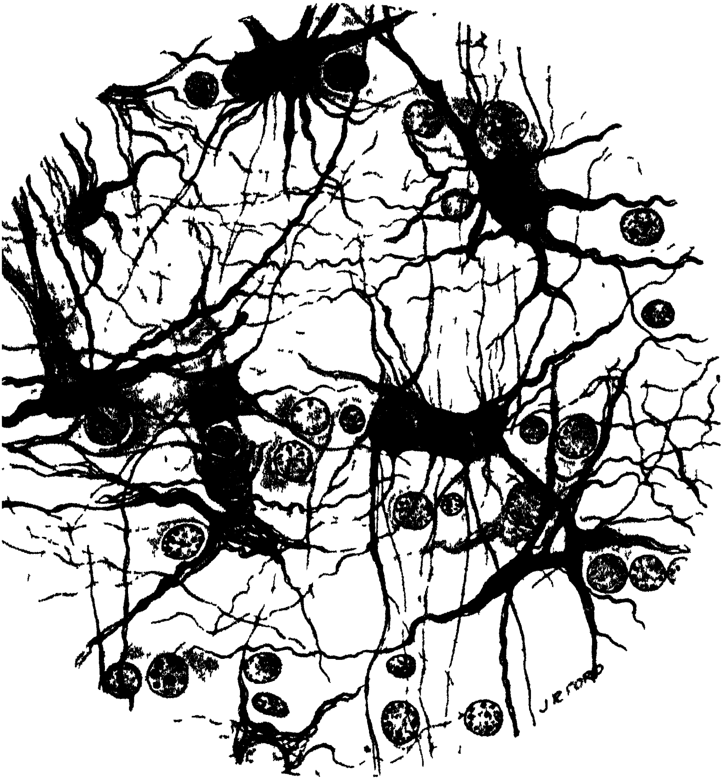
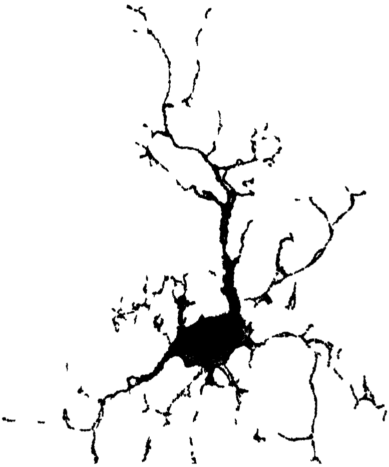


Fig. 5.



The pieces are trimmed and warmed in some fixing fluid as by the microglia method. Frozen sections, which must be as thin as possible, are collected in a Petri dish of distilled water to which 10–20 drops of ammonia are added. After washing in distilled water they are placed for 1 to 5 minutes in the solution of silver carbonate prepared with sodium carbonate referred to above, but diluted to 45 c.cm. only (strong solution). They are then washed one by one either in distilled water or in 95 p.c. alcohol and transferred into 1 p.c. formalin, *which in this case should not be agitated.* Wash, tone, fix, dehydrate and mount as by the microglia method.

In particularly difficult instances Del Río-Hortega has found it expedient to immerse the sections either in 95 p.c. alcohol or 5 p.c. anhydrous sodium sulphite before the silver bath for variable periods of time up to 24 hours.

(2) *Penfield's Modification* (*32*).—Pieces 3 mm. thick are fixed for 2–12 hours in formol-bromide and then mordanted in 95 p.c. alcohol for another 36–48 hours. After washing for at least 4 hours in running tap-water to remove the alcohol, they are cut by freezing. The sections are washed in distilled water to which a few drops of ammonia may or may not be added. For the impregnation Del Río-Hortega's strong solution of silver carbonate is used, but the sections are left therein from 15 minutes to 2 hours "as determined by trial." They are not washed, but passed directly into 1 p.c. formalin and agitated, as in Del Río-Hortega's method for microglia. Wash, tone, fix, dehydrate and mount as above.

V. METHODS FOR THE STUDY OF PERIVASCULAR MACROGLIA.

Del Río-Hortega has quite recently shown that neuroglia cells, both protoplasmic and fibrous, appear to be more intimately and more frequently connected with blood vessels than hitherto suspected. For the study of this important relationship he (*21*) recommends the following modifications of his microglia and oligodendroglia methods:—

(1) The carbonate of silver method for the demonstration of the microglia, as described at page 95, but with a short sojourn of the sections in the impregnating fluid.

(2) As (1), but, before passage into the silver bath, the sections are immersed for 10 minutes or longer into a watery 5 or 10 p.c. solution of anhydrous sodium sulphite freshly prepared.

(3) An expedient similar to that suggested by Penfield—viz. short fixation of the tissue in formol-bromide, followed by a passage for 12–24 hours into 95 p.c. alcohol and subsequent return

for 1–2 days into formol-bromide. Cut, wash, impregnate, reduce and mount as by the microglia method.

(4) A pyridine modification, to be carried out thus: fix for 1–2 days in formol-bromide; make frozen sections and wash them in the usual way; pass them into pyridine for 10–20 minutes; wash them twice, and proceed as by the oligodendroglia method.

VI. METHODS FOR THE DEMONSTRATION OF GLIOSOMES AND MITOCHONDRIA.

Though mitochondria were very likely seen in ependymal cells by Lobenhoffer (*27*), and in the protoplasm of neuroglia cells by Held (*24, 25*) and Spielmeyer (*35*), full credit must be given to Nageotte (*29, 30*) for their first description. He was also the first to observe, along and within the protoplasmic expansions of macroglia cells, granules which appeared to him as secretory in nature, and derived in part at least, from a transformation of the mitochondria (*31*). He therefore suggested considering the macroglia as "an interstitial gland annexed to the nervous system." Practically at the same time, and independently of Nageotte, similar observations were made by Mawas (*28*), who likewise concluded that macroglia cells form "*une immense glande*," diffuse to the entire central nervous system. The same granular appearances were studied by v. Fieandt (*22*) by means of a method based on fixing the nerve tissue in Heidenhain's sublimate-trichloracetic mixture, and staining the paraffin sections with Mallory's phosphotungstic hæmatoxylin. Fieandt showed that they were more numerous than hitherto suspected, and termed them "gliosomes." In a subsequent paper (*23*) he admitted that his gliosomes were in part identical with mitochondria, but could not agree with Nageotte as to the transformation of these into a secretory product. He was inclined to accept the view hinted at by Held and expressed by Spielmeyer, that the gliosomes of protoplasmic neuroglia cells are equivalent to the fibres of fibrous neuroglia, and that the former may become transformed into the latter. Subsequently Achúcarro (*1*) showed that granular and rod-like formations (mitochondria), as well as secretion granules (gliosomes), could be impregnated by his tannin and silver method. While agreeing with Fieandt that mitochondria disappear from the protoplasmic

EXPLANATION OF PLATE X.

Fig. 7.—Oligodendroglia cells of the cerebral cortex of an adult monkey.
Del Río-Hortega's modified carbonate of silver method. × 900.

Fig 8.—Gliosomes of macroglia cells of the grey matter of the human cerebral cortex.
Cajal's uranium nitrate method. × 965.

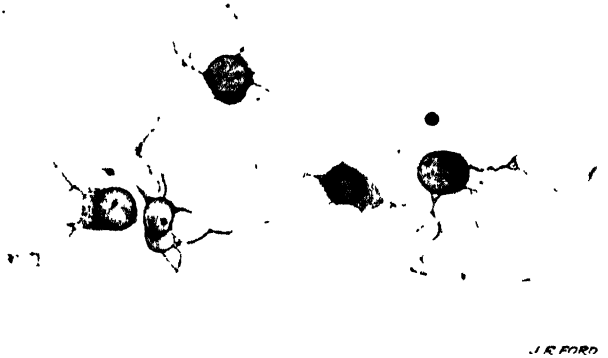
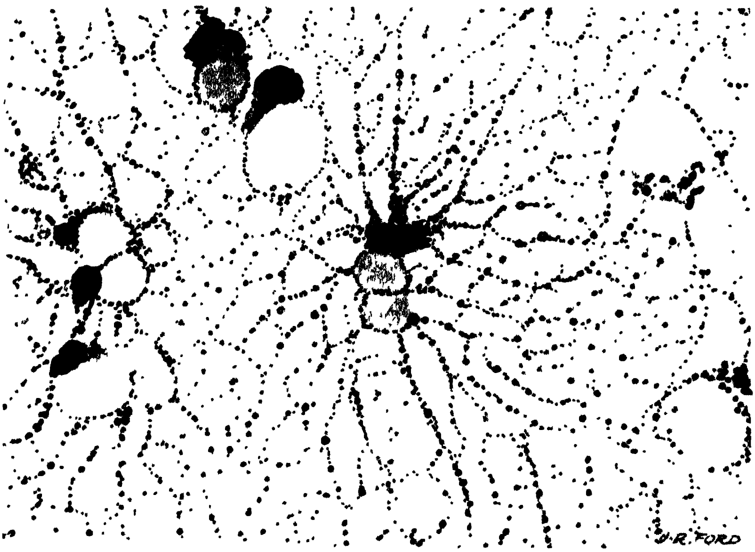


Fig. 7.



neuroglia when fibres become differentiated, he accepted Nageotte's and Mawas' view as to the secretory nature of the gliosomes, and regarded "the protoplasmic neuroglia tissue as an interstitial gland" capable of influencing the activity of nerve elements and of contributing "to the endocrine harmony of the organism" (*2*). These suggestions were favourably considered by Cajal (*5*), who showed that gliosomes occur in great number in the cytoplasm and processes of macroglia cells, where they occupy the minute spaces visible in specimens stained by the gold chloride and sublimate method. Quite recently Del Río-Hortega (*20*) has pointed out that mitochondria and gliosomes occur also in ependymal and oligodendroglia cells, and that these granular formations are certainly related to one another, though it is not clear in what degree; in some cases a distinction between them is easy, in others almost impossible. Apart from the classical methods for the demonstration of mitochondria and those of Fieandt and Achúcarro, which are outside the scope of this paper, the following are suggested:-

(1) *Cajal's Uranium Nitrate Method for the Demonstration of Gliosomes* (*8*)—This is only a modification of Cajal's well-known method for the impregnation of Golgi's internal apparatus. The difference consists in leaving the tissue in the fixative (uranium nitrate, 2 grm.; formalin, 15 c.cm.; distilled water, 85 c.cm.) 2 to 3 days (instead of some hours), and prolonging the impregnation in 1·5 p.c. $AgNO_3$ to 2–3 days or more. The results obtained are illustrated by fig. 8, showing a great number of intensely stained gliosomes all along the processes of protoplasmic neuroglia cells of the human cerebral cortex. The Golgi apparatus, though over-impregnated, is likewise seen.

(2) *Del Río-Hortega's Iron-alum and Silver Carbonate Methods for the Demonstration of Gliosomes and Mitochondria* (*20*)

(*a*) *Simple Process with Impregnation at Room Temperature.*—Thin slices of fresh tissue are fixed for one up to three or four weeks (in winter) in 10 p.c. formalin containing 5–8 grm. of iron-alum. Frozen sections, about 10 μ thick, are washed first in ammoniacal water and then in distilled water and passed into the silver carbonate solution, presumably in use for the demonstration of microglia.* They remain therein for 1 to 5 minutes, when they are washed for 15–20 seconds in distilled water and reduced in ½ p.c. formalin. Wash, tone, fix and mount in the usual way. The critical phase of this process arises when the sections are washed after the impregnation; if they are not washed at all or too little only the largest granules become stained; if they are washed too much an excessive amount of silver is extracted, and the method may fail.

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* The author is not clear on this point, and says only, "impregnar en licor de carbonato argentico (formula ordinaria)."

(*b*) *Impregnation in the Warm.*—Proceed as described under (*a*), but add a few drops of pyridine to the silver carbonate solution and warm this over a flame up to 45°–50° C. Wash the sections in distilled water, 1–3 minutes; reduce in formalin the concentration of which may vary from ¼–10 p.c. By the use of weak solutions (¼–2 p.c.) mitochondria become impregnated both in neuroglia and nerve cells, while more concentrated solutions (5–10 p.c.) should be preferred for the demonstration of gliosomes. This process can be employed for the impregnation of gliosomes of oligodendroglia cells; in this case, however, the silver carbonate solution should be a little diluted with distilled water, and 95 p.c. alcohol should be added to it instead of pyridine.

(*c*) *Double Impregnation.*—For the demonstration of mitochondria and gliosomes in ependymal cells, or when the methods described under (*a*) and (*b*) have given unsatisfactory results The tissue is fixed for 3–4 days in the following:—

FIXING SOLUTION (Formol-bromo-iron).

Formalin . .	10 c.cm.
Distilled water	90 c.cm.
Ammonium bromide	2 grm.
Iron alum . . .	6 8 grm.

Frozen sections are collected in ammoniacal water, washed in distilled water, and passed for 5–15 minutes into 2 p.c. silver nitrate. This should be warmed a little before quickly washing the sections in distilled water, and impregnating them for 1 minute in strong silver carbonate solution; wash very quickly in distilled water; reduce in 1 p.c. formalin. Wash, tone at room temperature, fix, dehydrate and mount in the usual way.

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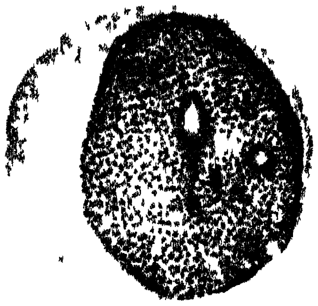
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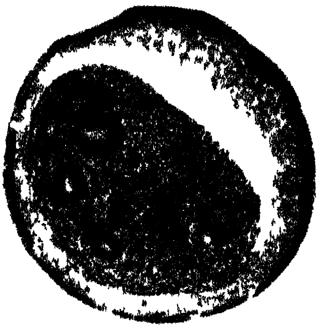
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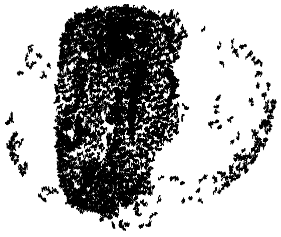
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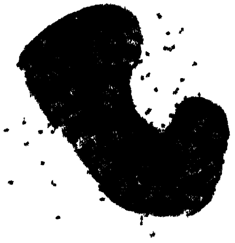
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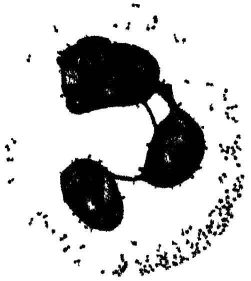
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VII.—THE PRINCIPLES OF HÆMATOLOGICAL DIFFERENTIATION.

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Director of the Institute of Pathology, Charing Cross Hospital, London.

(*Read February* 17, 1926.)

Two Coloured Plates.

The nomenclature of the various types of blood cells has become extraordinarily complicated for a number of reasons—viz. different writers have employed criteria of specificity, which other writers have denied. The subject is discussed in considerable detail by Naegeli, Pappenheim, and Ferrata. I propose to describe only purely microscopic results, which I contend are sufficiently distinctive to enable the cells to be grouped into classes. It is convenient first to describe the cells found in normal human blood, and then to discuss their relationship to the cells found in the blood-forming tissues. I shall not deal with the hæmoglobiniferous elements because these have been described elsewhere (Piney, 1924).

It is essential first to mention the technique adopted: films of blood are dried in air and stained with the stain which I described in 1925—viz. Jenner's solution followed by a modified Giemsa solution. The microscopic details have been described and the drawings made from preparations examined with a Watson 2 mm. oil-immersion objective, 10 Holos ocular and Holos immersion condenser, using the edge of the flame of an oil lamp as the source of illumination.

In normal blood it is possible to distinguish the cells into two groups—viz. those with granules in their cytoplasm, and those

EXPLANATION OF PLATE XI.

Fig. 1.—Myeloblast: Note the finely stippled character of the nucleus and the absence of condensation of basi-chromatin at its edge.

Fig. 2.—Lymphoblast: The nuclear stippling is coarser than in the myeloblast and forms a thin nuclear membrane.

Fig. 3.—Pro-monocyte: The cell has many of the characters of the myeloblast, but, on the left-hand side, there is a tendency for the basi-chromatic dots to form thin strands. (Cf. fig. 7.)

Fig. 4.—Premyelocyte: The nuclear characters are practically identical with those of the myeloblast, but the cytoplasm shows early eosinophilia and already contains a few granules.

Fig. 5—Metamyelocyte: The cell is mature except for the absence of nuclear lobulation.

Fig. 6.—Neutrophilic polymorphonuclear.

with no such differentiations (it must be understood that mitochondria are not included in the term granule).

The granular cells possess lobulated nuclei and a faintly oxyphilic cytoplasm in which are embedded numerous granules, which may be neutrophilic, eosinophilic or basophilic in their staining reactions, but each type of granule is peculiar to one type of cell—i.e. mixtures in the same cell are not found. The most characteristic feature of the nuclei of these cells is the very sharp distinction between the basi- and oxy-chromatin in the nucleus, which results in the development of a sort of fish-scale appearance in stained films.

There is another cell type which is not yet classified with certainty—viz., the large hyaline leucocyte or monocyte. This cell possesses a nucleus with a variable amount of nuclear polymorphism, a faintly basophilic cytoplasm, and numerous azurophilic granules in its cytoplasm. The finer structure of the nucleus is characterized by a sharp distinction of the basi- from the oxy-chromatin, although no fish-scale appearance occurs. In the arrangement of the nuclear constituents it therefore resembles the granulocytes. Its nucleus has another similarity in that it tends with increasing maturity to become lobulated in a complicated manner, as do the nuclei of neutrophilic, eosinophilic and basophilic leucocytes.

The non-granular cells are commonly termed lymphocytes; their cytoplasm occasionally, especially in large forms, contains irregular azurophilic masses, but this is not invariable, and the granules in no way resemble those of the monocyte. The structure of the nucleus of the lymphocyte is entirely different from that of the granulocytes in that there is no sharp distinction between oxy- and basi-chromatin. The basi-chromatin is collected in large masses at the edge of the nucleus, and these gradually fade away at their edges so that the central part of the nucleus is paler but is still basophilic. These cells show very little tendency to nuclear polymorphism, and complicated lobulation never occurs.

EXPLANATION OF PLATE XII.

Fig. 7.—Mature monocyte (large hyaline leucocyte).

Fig. 8.—Mature monocyte.

Fig. 9.—Mature monocyte: The cell is over-stained with Giemsa so as to show the azurophilic granulation.

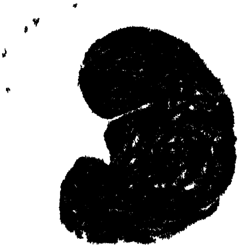
Fig. 10.—Eosinophilic premyelocyte.

Fig. 11.—Mature eosinophilic leucocyte.

Fig. 12.—Basophilic myelocyte (mast-myelocyte).

Fig. 13.—Lymphocyte: The cell shows an unusual degree of basophilia of the cytoplasm, i.e. it approaches the appearance of the Turk cell.

Fig. 14.—Lymphocyte: The cell shows more distinctness of the chromatic masses than usual, and is to be interpreted as being a stage in the formation of a plasma cell.



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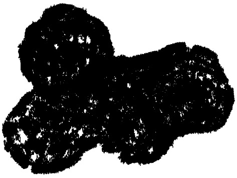

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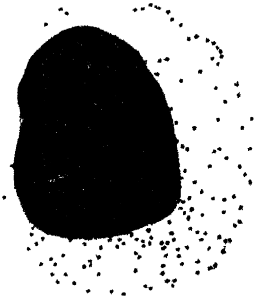

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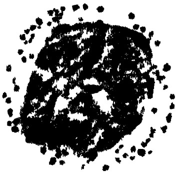

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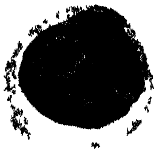

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It is well known that the blood-forming organs of the adult are the bone marrow and the lymphatic tissue all over the body, especially the lymphatic glands and spleen. The cells of the normal bone marrow are of three types—viz. granular leucocytes, non-granular leucocytes, and red cells. Only the two former are here considered. The granular leucocytes of the marrow contain neutrophilic, eosinophilic or basophilic granules identical with those of the normal blood, but the cells differ in having a simple round or almost round nucleus (myelocytes) which shows the same sharp distinction of basi- and oxy-chromatin seen in the cells with polymorphous nuclei. There are a variable number of similar cells with nuclei of similar stainability and an incomplete complement of granules lying in a faintly basophilic cytoplasm; these are premyelocytes, and their granules are azurophilic--i.e. have not yet differentiated into the mature form. These cells are to be distinguished into three types—viz. preneutrophilic premyelocytes with minute granules all of equal size, pre-eosinophilic premyelocytes with few granules of large but equal size, and prebasophilic premyelocytes with few large granules of unequal size. The nuclei of these cells show a sharp distinction between the two forms of chromatin, but there is no appearance of scaliness in the arrangement; the basi-chromatin is disposed in small masses throughout the nucleus, but there may be remnants of nucleoli visible in some of the cells. The non-granular leucocytes of normal marrow are very scanty in number and are all of the same type. The cytoplasm is slightly basophilic and the nucleus is large. The basi-chromatin is arranged as minute specks throughout the nucleus, and a variable number of nucleoli can be seen. It is important to notice that there is no condensation of the basi-chromatin either at the edge of the nucleus itself or around the nucleoli. These cells are the ones termed myeloblasts by Naegeli (1900), and regarded as the ancestors of the granulocytes. Pappenheim and many others refer to them as lymphoidocytes, and consider that they are the parent forms of all the blood cells. This controversy will be dealt with later.

In lymphatic glands the great majority of the cells are lymphocytes with the characters already described, but a small number of much larger cells with less nuclear density can always be found. These larger elements resemble the "myeloblast" in many particulars, and therefore are included in the conception of the lymphoidocyte by the upholders of the monophyletic view. Careful examination of these cells shows that, although the basi-chromatin is disposed in small particles throughout the nucleus, these are definitely coarser than those of the myeloblast. Nucleoli are always present, and the basi-chromatin is condensed around them and also at the edge of the nucleus in a slight but definite degree such as is never seen in the myeloblast. It is obvious that transitional stages between the non-granular myeloblasts and the partially granular premyelocyte may be found, but there are no such developments of the lymphoblast which by simple condensation of the nucleus becomes the typical lymphocyte.

There are a few other forms of leucocyte which require mention, although they occur in very small numbers of normal blood; these are the so-called Turk cell and the plasma cell. The former is a mononuclear non-granular cell with intensely basophilic cytoplasm, but the nucleus has all the diffuseness of basi-chromatic structure which is here described as being characteristic of the lymphocyte. The plasma cell is similar to the Turk cell, but the nucleus is excentric in position and the cytoplasm is vacuolated around it; the nuclear structure is typically that of a lymphatic cell.

It is now possible to arrange the leucocytes into classes according to their nuclear structure—i.e. into those with nuclei in which the basi- and oxy-chromatin are sharply marked off from one another, and those in which it is diffusely mingled.

Class I.	*Class* II.
Polymorphonuclear leucocytes.	Lymphocytes.
Myelocytes.	Turk cells.
Premyelocytes.	Plasma cells.
Myeloblasts.	Lymphoblasts.
Monocytes.	

The cells of group I. are all liable to extreme nuclear contortion with increasing maturation, while those of group II. show very little polymorphism.

The cells of group I. (except the most immature myeloblasts) contain oxidizing enzymes which can be demonstrated with suitable methods (oxydase reaction), while those of group II. contain no such ferments. It was at one time supposed that the absence of a positive oxydase reaction was evidence of the lymphatic nature of a cell, but here it is shown that the distinction can be made on purely structural grounds. It is clear that the conception of a lymphoidocyte or common ancestral blood cell is based upon defective appreciation of the fine structural differences between the lymphoblast and the myeloblast—i.e. the common parent must be sought further back, probably in the mesenchyme cells of the embryo.

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VIII.—FURTHER MODIFICATIONS OF THE OSMIC ACID METHODS IN CYTOLOGICAL TECHNIQUE.

By R. J. Ludford, D.Sc., Ph.D., F.R.M.S.,
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(From the Laboratories of the Imperial Cancer Research Fund.)

(*Read October* 21, 1925.)

Cytologists who have employed the osmic acid technique for the impregnation of the Golgi apparatus have found that the period of osmication can be greatly reduced if carried out at raised temperatures. A summary of the principal variations in this technique, which have been adopted by different investigators, is given in the table below:—

Summary of the Osmic Acid Methods employed for the Demonstration of the Golgi Apparatus. The tissue is first fixed, then washed and transferred to osmic acid at the temperatures indicated for varying lengths of time.*

Method	Fixative	Strength of Osmic acid	Temperature	Time
Kopsch . . .	2 p.c. osmic acid	2 p.c.	Room	19–22 days
Ludford (J.R.M.S., 1924)	Corrosive osmic	2 p.c.	Room Water at 38° C. for	14-21 days 2 days
Hirschler . . .	Modified Champy	2 p.c.	25° C.	15–18 days
Kolatschev . .	Modified Champy	1 p.c.	30–35° C.	3–7 days
Sjövall	Formalin	2 p.c.	35° C.	2 days
Nassonov . . .	Modified Champy	2 p.c.	35° C.	3–4 days

It will be seen that, in general, the higher the temperature at which the osmic acid is maintained, the shorter is the time required for the tissue to remain in it to ensure satisfactory impregnation of the Golgi apparatus. The higher temperatures, however, tend to distort the cytoplasm, and result in a considerable amount of non-specific reduction. In the modified Kopsch method recently described, this difficulty was overcome by leaving the tissue in osmic acid at room temperature for two to three weeks, and completing the reduction process in hot water. Recently experiments have been carried out with the view to shortening this method. Preliminary attempts at osmication for short periods at temperatures between 35°–40° C. were unsuccessful. The best results have been obtained by the following method :—

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* Full particulars of these methods are given by Dr. Da Fano in a review of the technique for the study of the Golgi apparatus in "Medical Science," xi. 1925, 319-26.

(*a*) The tissue is fixed in Mann's corrosive osmic solution for 18 hours.
(*b*) It is then washed in distilled water for 30 minutes.
(*c*) Osmication is carried out in an incubator at 30° C., using 2 p.c. osmic acid, for three days.
(*d*) The reduction process is completed by leaving the tissue for another day in water at 30° C.
(*e*) The tissue is then brought up through the alcohols and embedded in paraffin.

This method has been found to give excellent results with both mammalian and bird tissues.

A further useful modification is carried out thus :—

(*a*) The tissue is fixed, and then washed in distilled water as before.
(*b*) The osmication is carried out at 35° C. over three days: first day in 2 p.c. osmic acid; second day, 1 p.c. acid; followed by 0·5 p.c. acid on the third day.
(*c*) Reduction of the osmic acid is completed by leaving the tissue for a further day in water at 35° C.

With suitable material sections can be bleached, and the mitochondria then stained with acid-fuchsin by the method previously described (*2*).* Unless sections are sufficiently bleached it will be found difficult to stain the mitochondria. The following method of staining is recommended for sections prepared by this hot osmic technique :—

(*a*) After treatment with dilute potassium permanganate and sulphurous acid, slides are washed in running water.
(*b*) Aniline acid-fuchsin is poured on the slides, which are heated, then allowed to stand for about 30 minutes.
(*c*) The excess stain is then washed off under a tap, and the slides are brought direct to absolute alcohol, which is poured on the slides.
(*d*) When suitably differentiated they are transferred to xylol and mounted.

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* The italic figures within brackets refer to the appended Bibliography.

A combination of the iron-hæmatoxylin method with acid-fuchsin staining has been found to give a satisfactory result when cytoplasmic bodies, in addition to mitochondria and Golgi apparatus, are present.

The following procedure is employed :—

(*a*) Sections are mordanted in warm iron alum for 30 minutes, then washed in distilled water, and stained about the same length of time with hot hæmatoxylin (about 50° C.).

(*b*) For differentiation acid alcohol is employed.

(*c*) Slides are then rinsed with water, and treated with pyridine.

(*d*) After a thorough washing in running water, the acid-fuchsin staining method described above is employed.

This method gives the best results with Schridde preparations, in which the mitochondria, stained by the iron-hæmatoxylin, have been completely decolorized with acid alcohol and then stained by the fuchsin.

This is a good method to employ for pathological material. It is based upon the technique for demonstrating bacteria in tissues previously described by J. A. Murray. After Schridde preparations had been stained with iron-hæmatoxylin, Dr. Murray found that the mitochondria could be readily discoloured with acid alcohol, while bacteria and nuclei held on to the stain (*3*).

In successful preparations stained as I have described, mito chondria appear red, and bacteria dark blue to black, while various bodies in the cytoplasm produced as the result of the reaction to a virus—such, for example, as the so called "molluscum" bodies—are stained purple. This method has been employed in an investigation on the ætiology of molluscum contagiosum upon which Dr. G. M. Findlay and I have been engaged, and it has given excellent results.

The cytological methods described in this paper are the outcome of a large series of experiments which have been described in two former papers (*1*, *2*). No small amount of credit for these ultimate results is due to the Histological Technician of this Laboratory, Mr. E. G. Miller, for his enthusiastic care in dealing with the large number of experimental variations which have suggested themselves in the course of the work.

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IX.—A NEW METHOD FOR WASHING DIATOMS.

By G. H. NEEDHAM, M.Sc.

(*Read March* 17, 1926.)

ONE TEXT-FIGURE.

WHILE using collodion membranes for dialyzing various colloidal solutions it occurred to me that the use of these membranes would be excellent for freeing diatoms from the acids used in cleaning them. After several trials the following method was found very satisfactory :—

Into a clean and dry 250 cc. or 500 cc. Erlenmeyer flask pour a few cc. of collodion diluted with enough ether and alcohol (1 : 1) to make it flow freely. Cover the sides of the flask thoroughly by rotating while held down at an angle of 60°, draining the excess of collodion into the bottle again. Continue rotating the flask for a couple of minutes and then invert it on a ring stand. Allow the membrane to dry until no odour of ether remains, and then gently work the membrane free from the sides of the flask with the aid of a small stream of lukewarm water. Tie a glass tube 3 in. long and ¾ in. in diameter, flanged at both ends, to the neck of the membrane, and test it for leaks by filling with water, and holding by the neck that is tied to the flange while supporting the

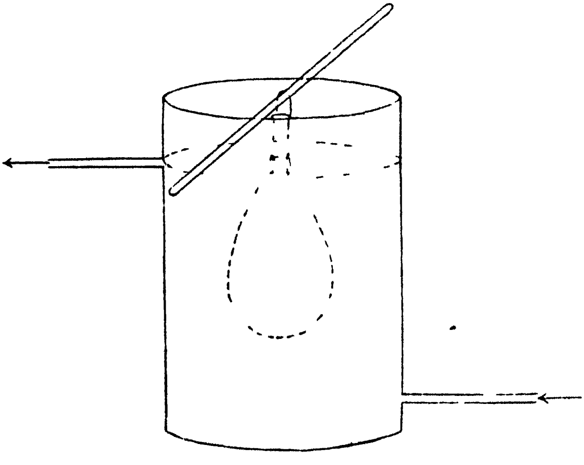

FIG. 1.

bottom of the membrane. These membranes should be kept in water until desired for use.

A little practice may be necessary before one can prepare membranes of the right thickness for rapidly dialyzing out the acid, and yet strong enough to withstand handling. The membrane, however, is quite tough.

In order to avoid having too strong an acid solution in the membrane, it is best to pour the diatoms and acid into 1000 cc. of distilled water in a glass cylinder, and allow the solution to stand overnight. Then syphon off the acid water and transfer the diatoms to the collodion membrane, which has previously been transferred to the water-filled container shown in fig. 1 Fill the membrane nearly to the neck with water. The water is allowed to run into the container in a small steady stream for from 24 to 48 hours, and then test the contents of the dialyzer with litmus paper or other indicator to be sure that no trace of acid remains. Finally, transfer the contents of the dialyzer to the 1000 cc. cylinder, breaking the membrane in order to wash with a wash bottle any diatoms adhering to the sides. Then, after settling, most of the water can be syphoned off, and the diatoms bottled in 50 p.c. alcohol.

X.—B. ÆGYPTICUS (KOCH-WEEKS' BACILLUS): ITS CULTURAL CHARACTERS AND MORPHOLOGY.

By MOHAMMED ALI, D.M. and S. (Cairo), D.T.M. and H. (London).
(From the Bacteriological Department, Guy's Hospital.)

(*Read March* 17, 1926.)

TWO PLATES AND ONE TEXT-FIGURE.

THE present investigation has been undertaken with a view, first of all, to determine more fully the biological characters of *B. ægypticus*, and, secondly, to attempt to deliminate the points of resemblance and difference between *B. ægypticus* and other members of the hæmophilic group, particularly *B. influenzæ* and *B. pertussis*.

HISTORICAL.

B. ægypticus was first recognized by Koch (*8*) * in 1883, who, whilst investigating epidemic cholera in Alexandria, also examined the conjunctival secretions from some fifty hospital cases suffering from "Egyptian ophthalmia." He at once recognized that this term included two different types of conjunctivitis, of which one was frankly purulent and due to the Gonococcus already described by Neisser, whilst the other, a more catarrhal type, could easily be differentiated by the constant presence of minute, slender bacilli in and amongst the pus cells, which he compared to the fine bacillus of mouse septicæmia.

Shortly afterwards, Weeks (*22*), working in America, and Kartulis, in Egypt, independently described the occurrence of this organism in epidemic conjunctivitis. The former, in the cultures which he established from the conjunctival secretion, observed two different types of bacilli—one identical with that which Koch had observed, whilst the other was the organism subsequently described by Neisser as the *B. xerosis*. Whilst he was readily able to isolate the *B. xerosis* in pure culture, all his efforts to obtain the *B. ægypticus* in a state of purity, unassociated with the *B. xerosis*, completely failed. But in spite of this he was able to show that the *B. ægypticus* was the etiological factor in the conjunctivitis by the fact that instillations into the conjunctival sac of a mixture of the two organisms invariably reproduced the disease, whilst the introduction of pure culture of the *B. xerosis* invariably failed to produce any reaction whatever.

Kartulis (*5*), on the other hand, unfortunately made the mistake of assuming that his cultures of *B. xerosis* were those of *B. ægypticus*, so that his description of its cultural characters is fallacious.

In 1890 (*24*), Weeks reported to the International Medical Congress at Berlin that he had now observed over one thousand cases of the disease, and that he had obtained the bacillus in pure cultures and successfully inoculated and reproduced the disease. But the first careful description of the cultured characters of the organism was only supplied by Morax in 1894 (*11*), and immediately afterwards (*14*) he noted the resemblance between *B. ægypticus* and the bacillus isolated from cases of epidemic influenza by Pfeiffer (descriptions of which had appeared in 1892). Kamen (*4*) a few years later described the organism anew and also insisted on its resemblance to the influenza bacillus, and from this time onwards all the workers upon *B. ægypticus* have insisted upon this resemblance.

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* The numbers in brackets refer to the appended Bibliography.

Rymowitsch was satisfied, by his own observations, that the two organisms were identical; but Luerssen (*9*) was equally confident that the two organisms represented two entirely separate entities. The reasons for these diverse views are fairly obvious, for on the one hand the two bacilli are so similar in their morphological, tinctorial, biological and cultural characters, yet on the other muco-purulent conjunctivitis, epidemic catarrh, "blight," or "pink-eye," or by whatever name the disease is labelled, is world-wide in its distribution and may occur in any individual, from the new-born to the very aged; and *B. ægypticus* never produces any serious constitutional disturbances comparable to those attending infection with *B. influenzæ*; neither does it appear to have any definite relationship, antecedent or simultaneous, to epidemic waves of influenza.

SHORT DESCRIPTION

B. ægypticus, as seen in the conjunctival secretion (Pl. XIII, fig. 1, and Pl. XIV, fig. 1), and when freshly isolated and grown on artificial media, is a small, short bacillus, ranging from 0·5 μ to 1·0 μ long by 0·5 μ in diameter.

It is aerobic, facultative anaerobic.

It is non-motile; does not form spores; does not retain the stain when treated by Gram's method.

It grows only at body temperature, and can be isolated and its early generations sub-cultivated only on or in media of which either animal or human blood or blood-serum forms an integral part and which has a H-ion concentration of Ph 7·8.

CULTURAL CHARACTERS.

Plate cultures on citrated rabbit's blood agar:—

After twenty-four hours' aerobic incubation at 37° C. the colonies appear as very small dew-like droplets, which are quite discrete. Size 0·5 to 1·0 mm. in diameter. Viewed by a hand lens the surface is convex; but when examined by a higher magnification (× 30) colonies are conical with a flat base (Types I and II); the surface shows radial stippling from the top of the cone to its base. The margin is clear and regular in outline (Pl. XIII, figs. 2 and 3). Refraction weak.

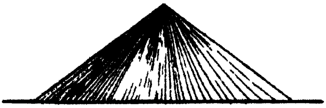
The colonies do not adhere to the surface of the medium, and so can be easily removed and readily emulsified in water or saline.

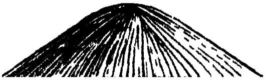
At forty-eight hours the colonies are larger in size, 1 to 1·5 mm., rarely 2 mm., slightly opaque and naked-eye resemble those at twenty-four. When magnified (e.g. × 30) numerous colonies retain the conical appearance, but others are umbilicated (i.e. show a small depression in the centre); radiations run from the centre and extend to the periphery, so that a very small clear marginal area with regular outline is seen around the colony (Type IV).

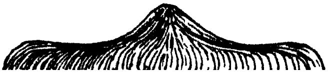
When the colony is examined by $\frac{2}{3}$-in. lens the centre is found to be more opaque than the periphery. The surface of the opaque portion exhibits a "Grumose" appearance (coarsely granular clotted appearance with particles like clustered grains).

The colonies show no tendency to coalesce, but remain discrete: are very little more adherent to the surface of the medium than those of twenty-four hours' growth, and emulsify as easily.

Whenever there occurs a colony of some extraneous organism contaminating the plate, colonies of *B. ægypticus* in its near neighbourhood are larger in size than those at a distance.


Type I.—Conical colony × 30.


Type II.—Convex colony. × 30.


Type III.—Umbonate colony. × 20.

Type IV.—Umbilicate colony. × 20.

At seventy-two hours the colonies have increased in size, and umbilication can be recognized naked-eye, although better with a hand lens.

Conical colonies are present, but are few in number. Umbonate colonies (Type III), probably the transition form between the conical and the umbilicate, are more numerous than at forty-eight hours. The stippling of the surface of the colony is very clear.

The margins are entire and regular in outline; no serrations are seen.

The Aged Colony. Even *at five days* the colonies remain discrete and never show any tendency to run together; but as the culture increases in age the conical form tends to assume either the umbilicate or the umbonate type, so that true cones are scanty after four days and are very rarely seen after five days' incubation.

No matter what their form, old colonies are more adherent to the medium, and usually come away entire when picked by the loop; and are no longer capable of complete emulsification.

VARIATION.

When *B. ægypticus* is sub-cultured through many generations and subsequently plated out, two varieties of colonies are frequently met with, so distinct in their respective characters as to give promise of permanent "variation."

1. Small conical colonies which remain so after forty-eight hours' incubation, but umbilicated later.
2. Larger flat colonies already umbilicate at twenty-four hours.

This promise, however, is not fulfilled, for if one of the conical colonies is picked and re-plated on blood agar plates, prepared with a minimum amount of blood, the bulk of the resulting colonies show umbilication after twenty-four hours. On the other hand, when one of the flat colonies is "fished" and re-plated on blood agar plates which is rich in blood, most of the colonies which develop assume the conical form.

This variation depends, therefore, upon the proportion of blood present in the medium. The greater the amount of blood, the more dominant is the conical variety; the converse holds equally true.

It was also observed that both types of *colony* after three days' incubation showed very fine serrated outlines, a feature which was absent from freshly isolated strains, or when sub-cultured for a few generations only.

Variation was also observed when there is change in either the reaction or the composition nature of the medium. For example, when the bacillus has been sub-cultured on blood-extract agar and then re-cultured on citrated blood agar, both variations in the shape of the colonies are at once observed.

EMULSIFICATION.

After long sub-culturing it becomes increasingly difficult to emulsify even the twenty-four hour growth of *B. ægypticus,* for in saline solutions of 0·9 p.c., 0·45 p.c. or 0·2 p.c., large clumps remain which sediment to the bottom of the tube, and the supernatant fluid when examined in hanging-drop preparations shows very few bacilli.

Distilled water is equally unsatisfactory for emulsification, even after shaking with glass beads in a mechanical shaker for five minutes.

The growth on blood-extract agar is easier to emulsify than that on citrated blood, and if distilled water or 0·2 p.c. saline is used for emulsification, and the suspension centrifuged at a slow speed to get rid of clumps, the supernatant fluid is usually sufficiently free from clumps, when examined microscopically, to be usable.

BOILED BLOOD AGAR (FLEMMING) (*29*, *32* and *33*).

Blood is mixed in the proportion of 0·25 cc. to 5 cc. liquefied agar boiled for one minute, sloped and allowed to set.

The growth on boiled blood agar is more luxuriant than on citrated blood agar, especially when the blood is human. The shape of the colonies does not vary much from that on citrated blood agar, but in size they are much bigger and may reach a diameter of 4 mm.

BOILED BLOOD-EXTRACT AGAR (FLEMMING) (*29*).

To 1 cc. of human blood, 5 cc. of tap-water is added and thoroughly mixed to hæmolyze the red blood corpuscles. To this 1 cc. of normal H_2SO_4 is added and kept for half-an-hour, and then the acid is neutralized with normal NaOH. The fluid is then boiled for five minutes in a flask. The blood coagulates in small shreds which sink to the bottom leaving a straw-coloured fluid on the top. The fluid is pipetted off and added to nutrient agar, ½ cc. of the fluid to 5 cc. of agar. It is not necessary to have sterile whole blood, since even blood clots collected from the specimens of blood taken for the Wassermann tests are equally useful. To the clot with a small amount of serum, formed from 5 cc. of blood, 5 cc. of tap-water is added and the clot is broken by a glass rod in order to dissolve the hæmoglobin, and the red fluid is decanted off into a flask.

To 5 cc. of this fluid 1 cc. of H_2SO_4 is added and kept for half-an-hour, and then neutralized with 1 cc. of normal NaOH and boiled for five minutes. The small shreds of coagulum which are formed are allowed to sediment, and the clear straw-coloured supernatant fluid is pipetted off and used for the preparation of the medium.

One cc. of the extract is added to 5 cc. of agar. This medium is usually quite clear and cannot be differentiated from ordinary agar in colour.

EXPLANATION OF PLATE XIII.

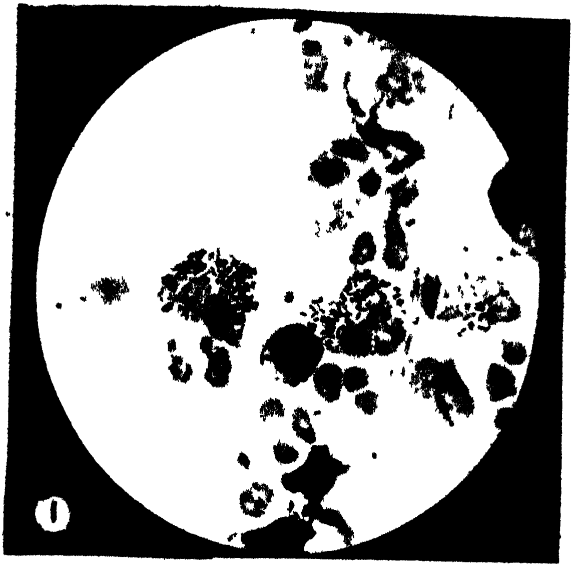
Fig. 1.—A direct film from the conjunctival discharge of a case of acute contagious conjunctivitis; showing pus cells containing numerous *B. ægypticus* together with some free bacilli.

Fig. 2.—Twenty-four hours' old colonies of *B. ægypticus*. × 13.

Fig. 3.—Forty-eight hours' old colonies of *B. ægypticus*. × 22.

Fig. 4.—Three days' old colony impression. × 17.

Fig. 5.—Three days' old colony impression; edge showing arrangement of bacilli. × 1000.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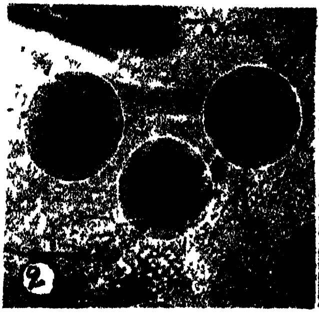
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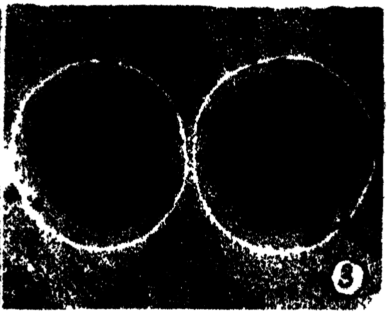
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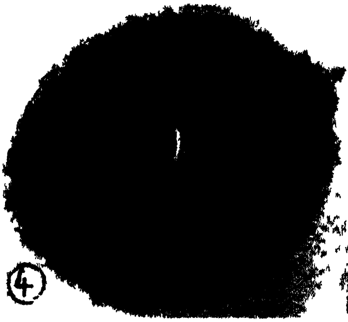
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B. ægypticus develops much more luxuriantly on this medium than on boiled blood agar.

The colonies are distinctly visible after twenty-four hours' incubation, and attain a diameter of 2 mm. at forty-eight hours After one week the colony may attain a size of 5 mm. in diameter.

The shape of the colony is precisely similar to that on citrated blood agar; it is, however, larger in size, more refractive to light, and slightly more opaque.

When nitric acid was used instead of H_2SO_4 in extracting the blood, the growth was scanty, and when HCl was substituted, *B. ægypticus* completely failed to develop after one, two, or even three days' incubation

It is probable that the Na_2SO_4 formed by the union of H_2SO_4 and NaOH favours the growth of the bacillus; the nitrates do so to a less extent, whilst the chlorides inhibit its growth.

It is also important that the medium should be adjusted to the optimum (Ph 8–8·2) for the growth of *B. ægypticus.*

Blood-extract medium is inhibitory to some extent to *B. xerosis,* which is usually found in association with *B. ægypticus,* for the colonies of *B. xerosis* on this medium are very small, dull and dry in appearance. Those of *B. ægypticus* are shiny and bigger in size; and are easily distinguished from the colonies of *B. xerosis* by the naked eye. *Brilliant green,* which is stated by Flemming to inhibit the growth of gram-positive bacteria when used in 1 in 500,000 solution without adversely affecting the growth of *B. influenzæ,* was used in an attempt to inhibit *B. xerosis* growth. Unfortunately, in 1 in 500,000 solution this dye inhibits the growth of *B. ægypticus* also; and in weaker solutions (1 in 1,000,000) both *B. xerosis* and *B. ægypticus* develop, and the colonies of the latter are scanty and small.

BLOOD SERUM.

Loeffler's blood serum slopes. At *twenty-four hours* some colonies developed when *B. xerosis* was also growing as a contaminant, otherwise no growth was obtained.

ORDINARY AGAR.

Attempts to cultivate a freshly isolated strain on the surface of agar slopes invariably failed, but after being sub-cultured on blood agar through many generations, the organism inoculated on to agar slopes yielded a very scanty growth after forty-eight hours' incubation; further sub-cultures on agar failed.

When mixtures of *B. ægypticus* and *B. xerosis* were planted out colonies of both organisms were abundant after forty-eight hours' incubation, and first sub-cultures could be obtained even from a four days' old culture. A second sub-culture, however, was never obtained.

Agar slopes were, therefore, inoculated with *B. xerosis* and incubated for twenty-four hours, and then melted, kept at 90° C. for ten minutes and resloped. These slopes were then inoculated with pure cultures of *B. ægypticus*, but no growth was observed after twenty-four hours, forty-eight hours or seventy-two hours' incubation.

The above experiment was varied by the preliminary cultivation of *B. xerosis* for forty-eight hours instead of twenty-four, but again *B. ægypticus* failed to develop.

Ascitic Agar.—No growth was observed except when *B. xerosis* occurred as a contamination.

Broth.—Slight turbidity (with flocculi) with a very fine deposit.

Ascitic Broth.—As ordinary broth, to which blood extract is added: 1 cc. of extract + 5 cc. of broth. There is slight turbidity after twenty-four hours and slight deposit after forty-eight hours.

Glucose Broth.—Scanty growth was observed.

Litmus milk.—No growth was observed. The addition of ¼ cc. of citrated blood to 5 cc. of milk, or hæmolyzed blood in twice that concentration, did not render the medium suitable for the multiplication of *B. ægypticus*, but growth occurred after twenty-four hours' incubation in litmus milk to which 1 cc. of blood extract had been added. No change took place in the colour of the indicator, and no clotting.

REACTION ON CARBO-HYDRATES.

The carbo-hydrates tested were put up in 1 p.c. concentration in serum water, with litmus as the indicator (Hiss's medium), 5 cc. in each tube. After inoculation and incubation for twenty-four hours smears were made from each sugar medium and stained by Gram's method, but no bacilli could be found; similar negative results were recorded after forty-eight and seventy-two hours' incubation. On the addition of 0·25 cc. of citrated rabbit's blood to the medium a very scanty growth was observed after twenty-four hours' incubation in the glucose tube, but no change in the colour of the indicator, nor could any change be noted at the end of forty-eight and seventy-two hours. After seventy-two hours it was found that the culture was dead.

Broth was then substituted for the serum water in these sugar media, and ¼ cc. of citrated blood was added to each tube. Again growth was only observed in the glucose tube; no change occurred in the colour of the indicator. In this medium the bacillus did not survive more than forty-eight hours.

Hæmolyzed blood was then used instead of citrated blood, but the result was the same as above.

ANDRADÉ MEDIUM (*32, 33*).

Agar compounded with 1 p.c. of the selected carbo-hydrate together with 1 cc. of H_2SO_4 blood to each 5 cc. of the medium, and acid fuchsin as the indicator (rendered colourless by NaOH and sloped), was the medium finally used for determining the fermentation reactions.

When the carbo-hydrate slopes were inoculated copious growth was obtained in twenty-four hours, accompanied by a slight reddish tinge in the medium after three days' incubation and distinct red coloration after four or five days. The results are here tabulated:—

Dextrose	+	Raffinose	0
Galactose	+	Mannite .	0
Maltose . . .	+	Glycerine	0
Lactose . .	0	Dextrin .	0
Saccharose . . .	0	Inulin	0

DURATION OF LIFE.

B. ægypticus when cultured on citrated blood agar lives for one week, and in very rare instances for ten days, especially when the strain has been sub-cultured for many generations. On boiled blood agar or blood-extract agar the bacillus lives for a longer time, and has been successfully sub-cultivated after fourteen days.

MORPHOLOGY.

After a few laboratory generations *B. ægypticus* has a tendency to depart from the typical form and size previously noted, in that film preparations from cultures twenty-four hours' old often show some longer forms of about 1·5 μ (Pl. XIV, fig. 2).

After *forty-eight hours'* growth long filamentous forms are often noted, varying in length from 4 μ to 14 μ (Pl. XIV, fig. 4) The individual bacilli are scattered and exhibit no characteristic arrangement.

After *four days'* incubation the filamentous forms are again less numerous and distinctly shorter, and the individual bacilli approximate very closely to the normal length.

After *six days'* incubation comparatively few well-stained bacilli with distinct outline are to be seen, whilst many faintly stained indistinct forms are present; presumably these latter represent dead or dying cells (Pl. XIV, fig. 6). Sometimes, in some strains, only short, filamentous forms are observed after six days' incubation; these on sub-culturing give rise to typical short bacillary forms.

THE FILAMENTOUS FORMS.

Many strains, but not all, show filamentous form when they are freshly isolated and sub-cultured for few generations. They are short, about 4 μ to 6 μ after twenty-four hours, and reach their maximum length after three days' incubation; they may occasionally attain a length of 30 μ.

The filaments are uniform in thickness, about 0·5 μ, throughout the whole length. The ends are rounded; no side branches are observed. The arrangement of the filament is variable; it may be practically straight, slightly curved, or coiled up in an irregular manner (Pl. XIV, fig. 5)

Filamentous forms are common after forty-eight hours' incubation, and gradually decrease as the culture gets old. After six days' incubation they are very scarce, but in few instances short filaments, 4 μ in length, are observed.

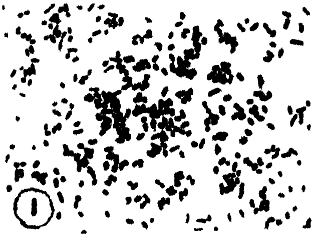
The formation of filaments is primarily dependent upon the reaction of the medium. They are commonly found when the reaction of the medium is near the acid range—that is, 6·8 (Pl. XIV, fig. 7) to 7·2 Ph—and are gradually lost as the reaction of the medium rises above 7·4 Ph. They are entirely absent at Ph 8·0 to 8·4, and at this point only typical short bacilli are observed.

After long sub-culturing the bacilli are seen to assume only very short forms, about 0·5 μ; the longer forms, about 1 μ or more, are rare after twenty-four hours' incubation. After forty-eight hours the longer forms, about 1 μ, are abundant.

When the bacillus is sub-cultured for many generations on a medium of constant Ph the property of producing filamentous forms is gradually lost, even if the reaction is as low as Ph 6·8.

EXPLANATION OF PLATE XIV.

Fig. 1.—Twenty-four hours' fresh culture of *B. ægypticus*. × 1000.
Fig. 2.—Twenty-four hours' fresh culture showing filamentous forms. × 1000.
Fig 3.—Forty-eight hours' growth. × 1000.
Fig. 4.—Three days' fresh culture showing filamentous forms. × 1000.
Fig 5.—Three days' growth showing filamentous forms. × 1000.
Fig. 6.—Five days' growth showing dead and dying forms. × 1000.
Fig. 7.—Forty-eight hours' growth in acid (Ph 6·5) medium showing filamentous forms. × 1000.
Fig. 8.—Twenty-four hours' culture after long sub-culturing. × 1000.
Fig. 9.—Twenty-four hours' culture anaerobic growth. × 1000.
Fig. 10.—Forty-eight hours' culture anaerobic growth showing filamentous forms. × 1000.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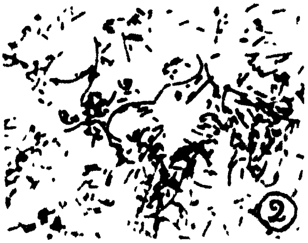
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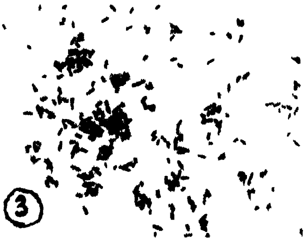
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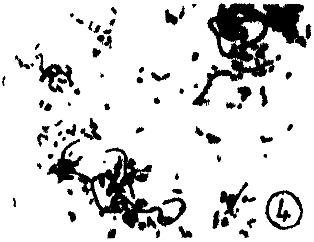
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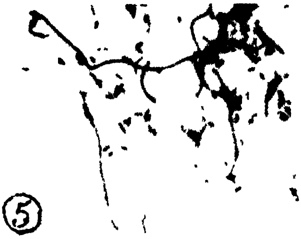
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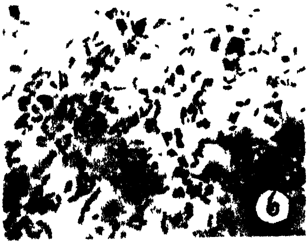
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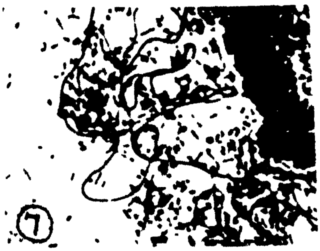
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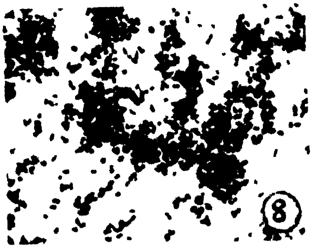
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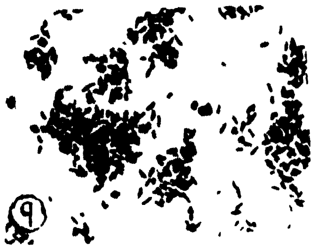
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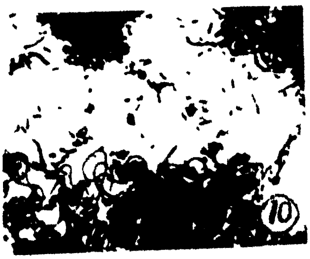
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But always when the reaction is changed in the acid direction filamentous forms re-appear.

Under anaerobic conditions filamentous forms are common, and may be developed from strains which have previously lost the property of forming filaments by sub-culturing repeatedly under *aerobic* conditions, and that without any alteration in the H-ion concentration of the medium (Pl. XIV, fig. 10).

In conclusion, I wish to take this opportunity of expressing my thanks to Professor Eyre for the facilities he has placed at my disposal and the kind assistance he has given me in my work; and also to Mr. Durrant, who prepared all the photomicrographs and diagrams to illustrate this paper.

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XI.—ON THE EFFECTS OF β-RADIATION ON COLPIDIUM COLPODA AS SEEN IN STAINED SPECIMENS.

By J. C. MOTTRAM.

(From the Research Laboratories, The Radium Institute, London.)

(*Read May* 19, 1926.)

FOUR TEXT-FIGURES

COLPODA is an infusorian commonly found in the soil. Its life-history has been closely studied, and as a result methods for its cultivation under controlled experimental conditions are now available (*1*).* Thus it forms excellent material for the study of radiation of living cells. The culture medium used was a solution of salts containing ammonium phosphate and glycerine recommended by Mr. Ward Cutler, of Rothamsted Experimental Station, to whom I am much indebted for technical details, the gift of cultures, etc. The cultures contain, besides the protozoa, a micro-coccus which grows at room temperature and upon which *colpoda* feeds.

EXPERIMENTAL CONDITIONS.

During radiation a small quantity of a young culture was confined between a slide and a thin coverslip (0·1 mm. thick), separated by glass slips (1·0 mm. thick). Enough culture was used to form a drop 0·5 cm. in diameter. The cell was made air-tight with paraffin wax. Thus set up, the organisms will remain healthy for about ten days. The β radiation was applied through the coverslip and was obtained from a radium applicator of 110 mgms.—$RaBr_2 4H_2O$ spread over 4 sq. cm. screened by 0·12 mm. of silver. Exposures of 5, 12, 24 and 72 hours were given. The radiated and control specimens were fixed in sublimate picric osmic acid mixture. The organisms were manipulated by the open-tube pyroxylin method devised by Dr. J. A. Murray (*2*), to whom I am indebted for a personal demonstration of his method. Several staining methods were employed, and especially Heidenhain's iron hæmatoxylin.

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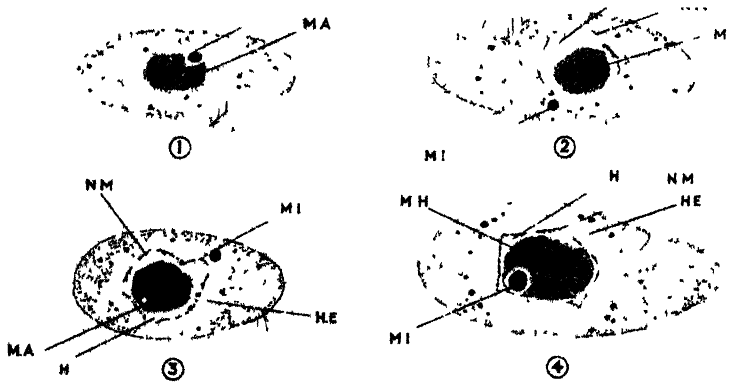
* The italic figures within brackets refer to the "References" at the end of the paper.

THE OBSERVED HISTOLOGICAL CHANGES.

Many changes were observed in the 72 hour specimens, but as these are probably in many cases secondary effects, attention was particularly directed to the primary effects seen after short exposures. It is these early changes that are likely to be of value from the point of view of radio-biology. The first two departures from the normal were seen in the macro-nucleus and in the superficial mitochondria. The nuclear changes were as follows:—After 5 hours (see fig. 2) the chromatin granules of the macro-nucleus (M.A.) were seen to be separated from the cytoplasm by a zone of hyaline material (H.). This clear zone was bounded externally by a fine faintly stained membrane (N.M.), to the inside of which a few granules of chromatin were attached. The micro-nucleus (M.I.) which normally (see fig. 1) lies close to the macro-nucleus now (see fig. 2) is seen to lie outside the membrane bounding the hyaline material.



Figs. 1-4.

These appearances suggest that there has been an increase of the hyaline material of the nucleus (the hyaloplasm) which has distended the nuclear membrane separating it from the chromatin; though a few granules of chromatin remain attached to it.

Specimens radiated for 12 hours show an exaggeration of this effect, the hyaline material being more abundant. In 24 hour specimens (fig. 3) hyaline material is seen to lie outside (H.E.) as well as inside (H.) the nuclear membrane (N.M.), which has to some extent collapsed and is lying in folds around the chromatin.

The external hyaloplasm (H.E.) has no sharp boundary, but fades gradually into the surrounding cytoplasm. These appearances suggest that the accumulation of fluid which first occurred within the nuclear membrane later diffused out into the cytoplasm, but did not mix with it. The 72-hour specimens (fig. 4) show the nuclear membrane collapsed close to the macro-nucleus and the hyaline material lying almost all external to it. The micro-nucleus which is first pushed away from the macro-nucleus now again lies close to it.

Turning now to the mitochondria, those which lie very close to the surface in the normal are rod-shaped, and lie in longitudinal lines down the whole length of the organism like chains of bacteria. These lines appear to be co-related with the cilia, which are similarly arranged, but whether they lie under or between the rows of cilia is difficult to decide. Exposure to radium even for a few hours entirely destroys this regular arrangement. They are then seen to be scattered irregularly over the surface, and further, the rods instead of lying parallel to the surface now lie at all angles. Longer exposures cause further disturbances with the collection of them at the two ends of the organism. This seems to be related to the swelling of the centrally-placed macro-nucleus, which measurements show increases the thickness of the organism in the ratio 7/4, and thus causes their displacement.

DISCUSSION.

It is well established that nuclear changes follow the exposure of cells to β-radiation; these changes are especially noticeable during mitosis when fragmentation, derangement, unequal splitting and migration of the chromosomes are seen. For this reason it has been concluded that chromatin is especially sensitive to radiation. These experiments show that the hyaline material of the nucleus also suffers great change, and this may well account for the abnormal behaviour of chromatin, during mitosis following radiation, for it is in this hyaline material that the various activities of the chromatin occur during mitosis. A characteristic early effect of radiation is a stoppage of cell-division. These experiments suggest that this effect also is due to a change in the hyaline material of the nucleus rather than to an action on the chromatin, for the reason that changes in the hyaline material occur long before any changes in the chromatin are to be seen.

The micro-nucleus in infusoria is said to control conjugation and endomixis, but as these do not occur in *colpoda* under artificial cultivation it is not possible to know whether these processes are interfered with by radiation. It may be mentioned, however, that no changes were observed in the micro-nucleus.

As regards the changes in mitochondria, in view of the action of β-radiation on cholesterol, changes at the surface of cells where cholesterol is present have been expected, but not hitherto described. These mitochondrial changes show that effects have been produced at or very close to the surface. It is well known from the work of J. Loeb and others that changes at the surface of cells profoundly affect their whole structure and life-processes, and it may well be that the nuclear changes following radiation are not primary effects but only secondary to some abnormality at the surface.

CONCLUSION.

The first two histological changes observed in *C. colpoda* following exposure to β-radiation are (*a*) an increase in the hyaline material of the macro-nucleus which accumulates between the chromatin and the nuclear membrane, and (*b*) a derangement of the superficial mitochondria which normally are arranged in longitudinal rows. (*c*) The experiments suggest that the mitotic irregularities following radiation are due to a change in the hyaline material of the nucleus rather than to any direct action on chromatin.

The radium used in this investigation was on loan from the Medical Research Council.

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SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.*

ZOOLOGY.

(*Under the direction of* DR. C. DA FANO.)

VERTEBRATA.

a. Embryology, Evolution, Heredity, Reproduction, and Allied Subjects.

Cells, Tissues, Fibres and the Specificity of the Germinal Layers.—V. PATZELT ("Zellen, Gewebe, Fasern und die Spezifität der Keimblatter," *Zs. mikrosc. anat. Forsch.*, 1925, **3**, 109–45, 1 fig.). Tissues forming organisms are built according to a common plan. Most of them can be subdivided into functional units, the cells. These may be united by bridges or processes or form plasmodia or syncytia. Plasmodia are due to cytoplasmic increase without adequate nuclear multiplication; syncytia to secondary fusion of cells; both form when function requires larger or more complete units. When the cell-content is fluid, the cell produces for its protection a thicker ectoplasm or a membrane; when mechanical activities are accomplished the cells produce a ground substance with or without fibres according to the functional need. The different aspect of tissues is due to the varying combination of these tendencies. The specificity of germ layers is limited, and only imparts certain characteristics to forms which are forced to combine in a variety of ways by adaptation to function.

C. D. F.

A Comparative Study of the Chromosomes of Mammals.—TH. S. PAINTER (*Amer. Nat.*, 1925, **59**, 385–409). The study of the chromosomes in different eutherian orders shows that there is a marked similarity in the chromosome complexes of all the species so far examined.

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* The Society does not hold itself responsible for the views of the authors of the papers abstracted. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, etc., which are either new or have not been previously described in this country.

The lowest number so far observed is 44 (rabbit) and the highest 60 (horse), but in all these cases there are the same general size limits and often a great similarity in the configuration of many of the individual chromosomes. In addition numbers *per se* are of secondary importance; the significant point is that, as far as can be gauged, the total amount of chromatin in the different mammalian groups is about the same and there is a remarkable stability in the chromosome associations. Inferentially one may surmise that the total number of genes is about the same in all groups. C. D. F.

Premature Maturation Divisions in Degenerating Oocytes of Mammals.—S. GUTHERZ ("Ueber vorzeitige Chromatinreifung an physiologisch degenerierenden Säugeroozyten des frühen Wachstumsperiode," *Zs. mikrosc. anat. Forsch.*, 1925, **2**, 1–38, 14 text-figs.). Description of the premature and abortive maturation divisions observed in the oocytes of certain mammals a little before or during the primordial follicular phase, viz. during the early postnatal period of development. According to the author they are due to the stimulating effect of decomposition materials (necrohormones) arising from the physiological degeneration of other nuclei. The mode of formation of atypical (olygopyrene and apyrene) sperms in prosobranchiate snails is in favour of this supposition because in this case also a connection between nuclear degeneration and cell multiplication has been noted. Gutherz's paper contains in addition a review of nuclear manifestations during cell degeneration. C. D. F.

Placentation.—A. SUBBA RAU ("Contributions to our Knowledge of the Structure of the Placenta of Mustelidæ, Ursidæ and Sciuridæ," *Proc. Zool. Soc., London*, 1925, 1027–69, 17 text-figs. and 3 pls.). In Zorilla the placenta is double discoidal with two marginal hæmatomes. In Ursus it is discoidal; when compared with the placenta of other carnivores, that of the bear is by far the most efficient as an organ of fœtal nutrition. The zonary type of placenta of the dog and the cat is the primitive form amongst carnivores; the double discoidal form of Putorius and Zorilla and the discoidal one of the bear are probably derived from the zonary type and are of a more specialized character. The primitive zonary type persists in the Felidæ, Lavidæ, Pinnipedia and Procyonidæ. In Zorilla the placental labyrinth is similar to that of the ferret. The endothelial cells of the maternal capillaries are much enlarged. Giant-cells are absent. The deeply staining homogeneous zone which occurs between the endothelium of the maternal capillary and the syncytial trophoblastic covering of Zorilla, Ursus and Putorius is probably laid down by the endothelial cells. The placenta of Ursus is lobulated and giant-cells are absent. The placenta of Herus is discoidal, mesometrically situated and hæmochorial in type. The lamellæ form a simple network and the lacunæ are wide. The lobed arrangement characteristic of the rabbit is not found and there is no interplacental cavity. The extraplacental wall of the uterus is thick. Giant-cells are present. The yolk sac splanchnopleure is simple. The bilaminar omphalopleure persists and forms the fœtal constituent of the yolk sac placenta. F. W. R. B.

Studies on Sex Differentiation in Fowls.—G. F. FINLAY (*Brit. J. Exp. Biol.*, 1925, **2**, 439–68, 6 pls.). Castrations and transplantations of gonads were performed on chicks as follows:—A. Male groups—(1) testes left; (2) castrated; (3) castrated and ovary engrafted; (4) testes left and ovary engrafted. B. Female groups—(1) ovariotomized and testis engrafted; (2) ovariotomized; (3) ovary left; (4) ovary left and testis engrafted. Of the male group 3, seven cases are described; the histology of one was not known; of the remaining six birds, five developed spermatic tubules in the stroma of the grafted ovarian tissue, while the ovarian graft was normal in the sixth. Of the male group 4, three birds are described in which the testes remained normal and the ovarian graft took; in one the grafted ovary developed testis tubules in the stroma. In the ovariotomized female group one bird developed a testis and one an ovotestis. In three pullets of the female group 4, the ovary and the grafted testis grew and remained normal. These experiments show that in the male the engrafted ovary can form yolk, and in the female the testis can develop and produce motile sperms. With reference to sexual characteristics the author concludes that castrated birds of both sexes are of a neutral type as regards plumage and head furnishings. The feathers, while of the general type and colour of the cock, are longer and less compact. If only testis is present both sexes develop perfect cocky plumage and head furnishings. If ovary is the gonad, both males and females develop henny plumage and head furnishings. If both testis and ovary are present in either sex, each gonad has its specific function, the testis causing a strong erect cocky comb to develop in the female as well as in the male, while the ovary tends to inhibit the plumage towards the henny type. F. W. R. B.

Sex Differentiation in the Bullfrog (Rana catesbeiana).—W. W. SINGLE (*Amer. Nat.*, 1925, **59**, 154–76, 34 figs.). In *Rana catesbeiana* the sex determining factors are distributed by the chromosome mechanism. There are two opposing sets of factors one of which (that for maleness, since the male frog is probably heterozygous for sex) is more probably carried by the autosomes (Bridges) than in the sex chromosome. The factors for maleness and femaleness are presumably present in every fertilized egg in a definite quantitative relation, a given sex being the resultant of the proportion in which these quantitative determiners exist. In the differentiated frog races this relation is such that sexes become clearly differentiated at an early larval stage. In the undifferentiated races the developing gonad is, at the same stage, neither a testis nor an ovary but a neutral structure combining the morphological features of both of them. C. D. F.

Oogenesis of Reptiles.—D. R. BHATTACHARYA ("Les inclusions cytoplasmiques dans l'oogénese de certains reptiles," *Thèse*, Paris, 1925, 1–102, 12 pls. and 2 text-figs). The original observations are confined to the description of the oögenesis of the tortoise (*Testudo Græca*), and a lizard (*Uromastix Hardwicki*). During the oögenesis of the tortoise, yolk is formed from mitochondria although vacuoles probably of a fatty nature are present in the cytoplasm. There are quite extensive nucleolar extrusions, but the extruded material diffuses into the cytoplasm and is not regarded as playing a direct rôle in yolk formation. The Golgi apparatus spreads out in the cytoplasm during growth of the egg, and there is an intrusion of Golgi bodies from cells of the follicular epithelium into the oöcyte, as has been described by Brambell in the fowl oöcyte. Essentially the same process occurs in the lizard, but no nucleolar extrusion is observed in the lizard oöcyte, and there is no indication of yolk formation in the stages studied. R. J. L.

β. Histology.

On the Structure of the Pituitary Body of Mammals: I.—M. Volterra ("Studio sull' anatomia comparata e la istologia dell' ipofisi in mammiferi e nell' uomo. I.", *Arch. ital. anat. embr.*, 1925, **22**, 397–455, 10 text-figs. and 1 pl.). The interstitial tissue of the pituitary body of mammals consists almost exclusively of reticular tissue the fibres of which are closely connected with the walls of capillaries and small blood vessels. Within the meshes formed by the reticular fibres cells are found similar to, if not identical with, the adventitial cells of Marchand or reticulum cells of Maximow, viz. with the histiocytes of the spleen and lymph-glands. True lymph spaces are not observed in the interstitial tissue of the pituitary. Their functions are carried out by the reticular tissue itself which, besides forming a supporting framework, facilitates the passage of fluid from the glandular cells to the capillary system. C. D. F.

Structure of Nucleoli and Paranucleoli.—A. S. Dogiel ("Zur Frage über den Bau der Kernkörperchen und Nebenkernkörperchen," *Arch. Russes anat. histol. embr.*, 1924–5, **3**, 369–406, 1 pl.). Investigations on sympathetic nerve cells of mammals. The nucleolus consists of two substances: one stainable by basic aniline dyes, iron hæmatoxylin and silver nitrate; the other stainable by acid aniline dyes and faintly also by silver nitrate and iron hæmatoxylin. Microchemically the two substances are identical with the nuclear basi- and oxychromatin and occur in changing proportions in different nucleoli. The oxyphil substance has no structure, while the basiphil substance consists of particles loosely adherent to one another. Parts of the nucleolus can become detached and move within the nucleus or migrate into the cytoplasm in which they afterwards persist unaltered. Nucleoli may multiply by gemmation, division or fragmentation giving rise to as many nucleoli as 12–15 or more. The accessory bodies of Cajal are only incompletely detached portions of nucleoli. The term "paranucleoli" (Flemming, Montgomery) should be dropped as they are in fact nucleoli. The vacuoles, sometimes observed in nucleoli, are artefacts. No difference exists either in the structure or number of the nucleoli of nerve cells from embryos, young or old subjects. Nucleoli are extremely resistant to degenerative processes. C. D. F.

Cell-Connections in Epithelia.—A. Kolossov ("Über die Beziehungen der Zellen zu einander und über die Saftkanälchen in Deck- und Drüsenepithelien und im glatten Muskelgewebe," *Arch. Russes*

anat. histol. embr., 1925–6, **4**, 1–20 & 143–8, 1 pl.). All cells of protective and glandular epithelia are provided with a delicate rim of modified protoplasm by means of which they adhere to one another. Between them thin intercalary plates become thus formed. The plates are not continuous but interrupted with a consequent formation of minute intercellular lymph-canals. In stratified epithelia these form closed systems; in pavement epithelia they communicate with sub-epithelial lymph-vessels; in glandular epithelia they give rise to the so-called intercellular capillaries. As a rule they are not visible in pavement epithelia, in part because the cells adhere more intimately to one another and in part because they are ultramicroscopical with the exception of places where stomata occur. Plain muscle cells are united in a similar way. No other connection exists between either epithelial or muscle cells, the well known bridges (cytodesms) and fibrils (tonofibrils) being artificial products. In fact epithelial cells have an alveolar and not fibrillar structure. C. D. F.

On "Lacunome."—A. Corti ((I) "Studi di morfologia cellulare: lacunoma, apparato interno del Golgi (trofospongio). Condrioma. Idiosoma," *Ric. morf.*, 1924, **4**, 313–422, 8 text-figs., 2 pls. (II) "Il lacunoma delle cellule dell' epitelio intestinale dell' uomo," *Arch. ital. anat. embr.*. 1925. **22**, 457–82, 1 pl.). Investigations on the intestinal epithelium of man, hedgehog, guinea-pig, mouse, rat, frog and salmon-fry and the gastric epithelium of the mouse and frog in fasting conditions by ordinary histological methods (iron hæmatoxylin after appropriate fixation and silver and osmic acid impregnations). In all cells investigated an intracellular system of lacunæ (lacunome) is seen consisting of a variable number of apparent cavities excavated in the cytoplasm but not delimited by a membrane. The lacunæ do not communicate with one another and contain a hyaline material the nature of which is unknown. As regards situation in the cell, shape and general aspect the lacunome corresponds to the Golgi apparatus, the former being only the negative histological picture of the latter, which should henceforth be termed "lacunar." The lacunome is similar to Parat and Painlevé's vacuome and differs from Holmgren's trophospongium in not having any communication with the cell exterior. It is entirely distinct from mitochondria and idiosome. This has a different situation (in the cells examined) and consists of the centrosome or centrioles (when existing), a cytoplasmic sphere (idiosphere) and the peri-idiosomic bodies.

C. D. F.

The Corium and Basement Membrane of the Nasal Mucosa.—L. Pietrantoni ("Il tessuto connettivo e la lamina basale della mucosa nasale," *Arch. ital. anat. embr.*, 1925, **22**, 283–96, 1 pl.). The connective tissue of the nasal mucosa of children has a lamellar structure. The laminæ consist of a very small amount of ground substance and many interlaced reticular fibres; they delimit spaces within which leucocytes, plasma cells and mast cells are found. In the adult, reticular fibres become almost entirely transformed into ordinary connective tissue. The basement membrane consists of very thin fibres of reticular tissue with a few elastic fibres. C. D. F.

Structure of Ligaments.—G. ANNOVAZZI ("Osservazioni sulla struttura dei legamenti," *Atti soc. lomb. sci. med. biol.*, 1925, **14**, 290–4). Histologically the ligaments of the dog, horse and man can be subdivided into four principal types: (1) without elastic fibres; (2) with elastic fibres parallel to the bundles of fibrous tissue and situated on their surface; (3) as (2) but with elastic fibres situated both on the surface and in the thickness of the fibrous bundles; (4) with thin elastic fibres mixed with the bundles of fibrous tissue.
C. D. F.

Nerve-Endings in the Nipple of the Male.—B. MARTYNOV ("Die Nervenendapparate in den Brustwarzen der Männchen," *Arch. Russes anat. hist. embr.*, 1924–5, **3**, 191–206 & 407–8, 1 pl.). In comparison with the nipple of females that of males shows an abundance of free terminal arborizations, a great scarcity of modified corpuscles of the Golgi-Mazzoni type and a total absence of so-called genital end-bulbs. No true Meissner corpuscles are found in the nipple either of man or woman; in their place end-bulbs occur within which nerve fibres and their secondary ramifications terminate in flattened expansions These bodies are tactile in function and physiologically equivalent to the Meissner corpuscles. C. D. F.

Nerve-Endings in Human Tendons.—J. TSCHURAJEV ("Die Nervenendingungen in den grossen Sehnen der unteren Extremitäten des Menschen (Sehne m. quadricipitis, lig. patellæ, retinac. patellæ, tend. Achillis)," *Arch. Russes anat. hist. embr.*, 1925–6, **4**, 21–30 & 149–50, 1 pl.). In the tendons of M. quadricipitis, L. patellæ, R. patellæ and T. Achillis of man, besides the organs of Golgi, many free terminal arborizations occur. These may be of two types; simple and complex, but they all show enlargements of varying dimensions from which secondary fibrils arise. They are all organs for the perception of general sensory stimulations. C. D. F.

The Fœtal Interstitial Gland of Equidæ.—A. C. BRUNI ("Appunti sulla struttura della ghiandola interstiziale fetale degli equidi," *Atti Soc. lomb. sci. med. biol.*, 1925, **14**, 318–26). The large interstitial cells, which form the bulk of the testis and ovary of equidæ during the last months of intra-uterine life, are provided with a vesicular nucleus and a granular cytoplasm. They lie in groups within the meshes of a network of sinusoid capillaries and are, in addition, supported by reticular tissue similar to that seen in other organs such as the liver and adrenals. Besides the large polyhedral cells, particularly next to the capillaries, smaller ones are found. In agreement with Bouin and Ancel the author thinks that the smaller cells give rise to the large ones and that they all are histiocytes. The fœtal interstitial cells appear to have two functions: the production of a material the exact nature of which is not known, and the phagocytosis of worn-out red blood corpuscles. At about birth their cytoplasmic content undergoes fatty transformation and the entire gland becomes transformed into masses of lipochrome which are subsequently re-absorbed. A new interstitial gland is then formed in the male only. C. D. F.

Structure of the Mammary Gland of the Aurochs.—I. OGNEFF ("Structure de la glande mammaire de l'aurochs femelle," *Arch. Russes anat. hist. embr.*, 1925–6, **4**, 19–44 & 59–68, 1 pl.). Essentially the structure of the mammary gland of the female of the European bison (*Bos bonasus*) is similar to that of the cow. In the aurochs, however, even if young the glandular tissue proper is very scanty and the production of milk equally scarce. This must have had an unfavourable influence on the young and the propagation of the species, now almost extinct. C. D. F.

Histology of the Ureter.—B. KARDASSEWITSCH ("Zur Histologie des Harnleiters," *Arch. Russes anat. histol. embr.*, 1925–6, **4**, 109–17 and 117, 1 pl.). Comparative histological investigation of the ureter of the horse and ox. The mucous membrane is lined in both cases by transitional epithelium which consists of 7–8 layers of cells in the horse and of only 3 or 4 in the ox. The flattened cells of the innermost layer are provided with a cuticle and the epithelium rests on a basement membrane in the horse only. In this animal in addition, the epithelium gives rise to short papillary formations. The blood capillaries of the submucosa lie very near the epithelium and their enlarged endothelia occasionally protrude into the epithelium.
C. D. F.

The Tyro-parathyroid System of Bats.—A. RINDONE ("L'apparato tiro-paratiroideo nei Chirotteri," *Arch. ital. anat. embr.*, 1925, **22**, 195-200, 2 text-figs.). In the genus Vesperugo the thyroid consists of independent lobes. Microscopically each lobe is formed by typical follicles lined with cubical epithelium; their size appears to be related to that of the animal body. The interfollicular epithelium consists of cubical or prismatic cells like those lining the follicles. The parathyroids vary in number and are embedded in the thyroid tissue, one of them being situated superficially in each lobe. C. D. F

Mitochondria of Spinal Ganglion Cells.—WEN-CHAO MA ("A Study of the Mitochondrial Elements of the Spinal Ganglion Cells of Beriberi Fowls," *Amer. J. Anat.*, 1925, **36**, 215–34, 2 pls.). The mitochondria in the spinal ganglion cells of chickens and pigeons show definite changes in experimental beriberi. These consist chiefly of granulation, clumping, or diffusion, general weakening of acidophilic staining reaction, intimate association with and intermediate change into a lipoid substance and ultimate transformation into neutral fat.
R. J. L.

Structure of the Beak of the Woodcock.—M. CLARA ("Über den Bau des Schnabels der Waldschnepfe (Scolopax rusticola L.)," *Zs. mikrosc. anat. Forsch.*, 1925, **3**, 1–108, 10 text-figs.). The anterior part of the bill of the woodcock is characterized by a honeycomb-like texture with bony spaces or lacunæ. Externally the spaces are closed by thick connective tissue; internally they are occupied by a variable number of laminar corpuscles of the type of the Herbst corpuscles. These are arranged round a venous sinus which is situated in the centre of each space and is delimited by a very delicate wall. The corpuscles, like probably all Herbst corpuscles, are not concerned with taste, but with the transmission of sensations of pressure C. D. F.

Mononuclears of the Frog's Blood.—M. R. Lewis ("A Study of the Mononuclears of the Frog's Blood in Vitro," *Arch. exper. Zellforsch.*, 1926, **2**, 228–43, 1 text-fig., 1 pl.). In hanging-drop preparations of blood from the frog's heart, the leucocytes become transformed into macrophages, epithelial cells and giant cells. The leucocytes live from two weeks to a month. Some of them hypertrophy and ingest foreign particles, thus resembling macrophages both in appearance and behaviour. The ingested material is taken directly into the cytoplasm where later a vacuole may, or may not, form around it. The hypertrophy of some cells, together with certain nuclear changes and the accumulation around the centrosphere of small granules, results in the formation of the epithelioid cells. The transformation into giant cells may occur either before or after the change into epithelioid cells, but the giant cells acquire in any case the characteristics of the Langhams type. The macrophages of the lymph, peritoneal fluid and spleen and the Kupffer cells also become transformed into epithelioid and giant cells.
C. D. F.

Blood Corpuscles of Rays.—A. Jokl ("Über vitalfärbare Eyrthrocyten-granulationen (Substantia metachromatico-granularis) beim Rochen nebst weitere Bemerkungen uber das Blut dieser Tiere," *Zs. mikrosk. anat. Forsch.*, 1925, **2**, 461–505, 1 pl.). Investigations on *Raja clavata* and *R. batis*. The blood is best obtained from the heart. 1·9–2·0% NaCl is isotonic with the corpuscles. The erythrocytes are elongated in shape and number about 160,000 in males and 90,000 in females. In fresh condition their cytoplasm is homogeneous, but, by supravital methods of staining, granules (substantia metachromatico-granularis) are seen at first in some erythrocytes and then in almost all of them. After a time the granules disappear again. Their formation is delayed by warming or shaking, favoured by cooling or mixing with hypertonic salt solutions. They are dissolved by absolute alcohol, ether, acetone, benzol, chloroform, concentrated solutions of cadmium, 1% acetic acid, 40% formalin, iodine tincture, 1% KOH, 1% OsO_4, 1% platinum chloride, CS_2, distilled water and xylol. They are insoluble in 10% lead acetate, magnesium chloride, potassium bichromate, petroleum-ether and corrosive sublimate. They are difficult to fix and stain without deformation. The substantia can be extracted by means of ether followed by acetone and probably is a lipoid near to myelin. The leucocytes of rays can be subdivided into: lymphocytes, granular mononuclears, eosinophils and mast cells. C. D. F.

Structure of the Teeth of Lampreys.—T. Timofeeva ("Contribution à la question de la structure et du développement des dents du Petromyzon Planeri et du Petromyzon fluviatilis," *Arch. Russes anat. histol. embr.*, 1924–5, **3**, 61–7, 2 pls.). The resistant layer of the teeth of *Petromyzon Planeri* and *P. fluviatilis* consists of hornified epithelium. The hornification process takes place continuously in the central portion of the epithelial papilla and appears due to a transformation into keratohyalin of microsomes (mitochondria). According to the author these arise from extruded nuclear material. C. D. F.

γ. General.

Nerve-Elements Grown in Vitro.—G. LEVI ("Ricerche sperimentali sovra elementi nervosi sviluppati in vitro," *Arch. exper. Zellforsch.*, 1926, **2**, 244–72, 10 text-figs.). By means of Peterfi's micromanipulator experiments can be carried out on embryonic nerve cells cultivated in vitro without impairing their biological properties. The neurite can be stretched without breaking; it then assumes a wavy appearance which lasts for some minutes. After pressure on a point either of the neurite or the neuroblast a swelling is produced from which fine amœboid processes may arise. If a portion of the neurite is cut off, the distal and occasionally the proximal end of the cut piece assume a brush-like shape and exhibit amœboid movements lasting about 7–8 hours, when the cut piece shows a beaded aspect and degenerates. The central stump generally degenerates in the manner described by Ingebrigsten, but, if the distance separating the stumps is not too great, they may unite again. This *restitutio ad integrum* is favoured by the embryonic state of the cultivated cells. The neurofibrillary substance appears as a very viscous gel which imparts to the neurone a great resistance against form-changes but is *per se* extremely labile and gives rise to an opaque precipitate if the neurite or the cell-body are injured. At the surface of the nerve cell, a somewhat more resistant pellicule exists which cannot be shown by histological methods, but becomes visible when the neurite is stretched or cut and the neurofibril fuse together. C. D. F.

Ossification of the Tracheal Cartilages of the Chick.—S. W. MJASSOJEDOV ("Die Metaplasie des Knorpels im Knochengewebe in der Trachea des Huhnes," *Arch. Russes anat. hist. embr.*, 1924–5, **3**, 231–44 & 421–6, 1 pl.). The cartilageneous rings of the trachea of the chick undergo ossification, not through an inward penetration of osteogenic connective tissue, but through a metaplastic transformation of the cartilage into bone. The process begins in the central portions of the cartilage and is characterized by the three phases of :—basiphil reaction, calcification and ossification. C. D. F.

Reabsorption of the Tail during the Metamorphosis of Amphibians.—F. J. de ASUA e I. COSTERO ("Sobre la reabsorción de la cola durante la metamorfosis de los amphibios," *Bol. r. soc. españ. hist. nat.*, 1926, **26**, 133–45, 2 text-figs. and 6 pls.). When the tails of amphibians begin to atrophy the nuclei of the muscle fibres involved migrate from their surface into the deeper portions where they undergo pycnosis, karyorrhexis and final degeneration. Probably under the stimulus of the materials set free from the degenerating muscle fibres and nuclei, the cells of the perimysium become transformed into large phagocytes, within which fragments of muscle fibres are observed until the end of the metamorphosis. The ultimate fate of these phagocytes is not known. C. D. F.

Tissue Cultures from Lungs.—F. J. LANG (" Über Gewebskulturen der Lunge. Ein Beitrag zur Histologie de respiratorischen Epithels und zur Histogenese der Alveolarphagozyten," *Arch. exper. Zellforsch.*, 1926, **2**, 93–122, 4 pls.). Tissue cultures of fragments of the lungs of young rabbits show that the alveolar phagocytes are mobilized amœboid connective-tissue cells, viz. histiocytes identical with Metschnikoff's macrophages or Maximow's polyblasts. They arise from elements situated in the alveolar septa and next to blood vessels just as similar cells arise from mobilized reticulum cells in tissue cultures of lymph glands. They, therefore, belong to the reticulo-endothelial system as this is understood by Aschoff and Kiyono. Under normal conditions the pulmonary histiocytes show very little phagocytic activity towards stains injected intra vitam ; but this activity becomes quite plain under the stimulus of cultivation in vitro or in the living organism under certain pathological conditions. C. D. F.

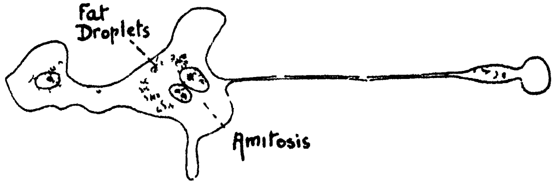
Periosteum and Perichondrium Cultivated in Vitro.—A. POLICARD and M. BOUCHARLAT (" Recherches sur les explanations de périoste et de périchondre," *Arch. exper. Zellforsch.*, 1926, **2**, 223–7). When cultivated in vitro both the periosteum and perichondrium of chick give rise to a proliferation of connective tissue cells without formation of either bone or cartilage. C. D. F.

The Repair of Bone.—T. H. BAST, W. E. SULLIVAN and F. D. GEIST (*Anat. Rec.*, 1925, **31**, 255–80, 14 figs.). In experimental bone lesions in rabbits the cambium layer, the osteogenetic cells lining the Haversian canals, and the endosteum are all active in the production of new bone. The union of the severed bone is strengthened by a dove-tail union made possible by the extension of the new bone forcing in the cut into the excavated spaces of the adjacent old bone. Reduction of the external bony callus is accomplished by osteoclasis and that of the internal bony callus by bone dissolution and osteoclasis. Cartilage when present arises from connective tissue cells at the cut ends of the fibrous periosteum. R. J. L.

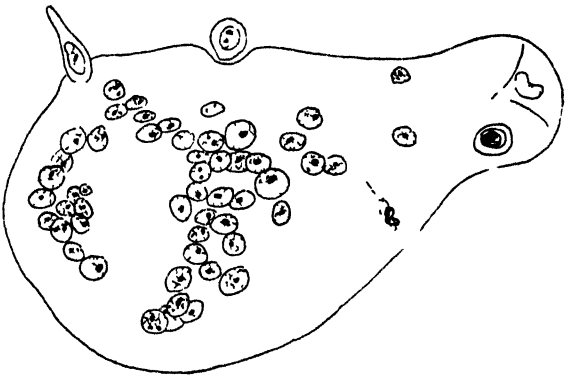
Influence of H-ion Concentrations on Mitochondria.—J. T. SCOTT ("The Effect of Different Hydrogen-Ion Concentrations on Mitochondria in the Liver Cell," *Amer. J. Anat.*, 1925, **36**, 385–97, 2 pls.). Mitochondria in the liver cells can be stained at the periphery of the block of tissue after four hours' incubation in physiological salt solution at body temperature. They are best preserved, as indicated by their staining reaction, when the medium is alkaline (pH between 7·5 and 8·0). Incubation results in loss of uniformity of staining reaction. Subsequent to incubation in a slightly alkaline medium there is a decrease in the number of mitochondria, but an increase in their size. R. J. L.

Epithelium in Tissue Cultures.—S. ISHIKAWA and S. SHIMOMURA (" Über die Phagozytose und Bewegung der Epithelien der Harnblase, der Gallenblase und der Zunge des Frosches in vitro," *Arch. exp. Zellforsch.*, 1926, **2**, 1–5, 2 figs.). The epithelial cells of the urinary bladder, gall bladder and tongue of the frog when cultivated in vitro exhibit active movement and phagocytic properties, like those of the cornea. R. J. L.

Giant Cell Formation.—E. BARTA ("Deficient Oxidation as a Cause of Giant Cell Formation in Tissue Cultures of Lymph Nodes," *Arch. exper. Zellforsch*, 1926, **2**, 6–30, 24 text-figs.). Cells migrating in tissue cultures from fragments of lymph glands behave differently according to the distance from the air surface at which they are situated. Those near to the air surface remain small, contain few fat droplets, do not fuse with neighbouring cells, do not produce giant cells, divide by mitosis. The cells situated at a distance greater than 0·5–0·7 mm. from the air surface become hypertrophic, contain many fat droplets and fuse with neighbouring cells, while their nuclei divide by amitosis without subsequent division of the cytoplasm, giving thus rise to giant cells. Addition of embryonic extracts to the plasma of the culture medium greatly diminishes the effects of oxygen deficiency, and cells moving in the deeper layers of the medium behave then almost like thos which have a sufficient oxygen supply. R. J. L.



Two cells fusing to form a giant cell



Giant Cell from deeper layer of plasma culture.

A Peculiar (Hermaphroditic?) Ovarian Tumour.—O. Berner (*Arch. intern. méd. exp.*, 1924–5, **1**, 825–48, 7 pls.). The material upon which this paper is based was obtained from a white Italian hen which had ceased laying and had begun to behave like a cock. At the post-mortem examination a small ovary was found which contained what appeared to be atretic follicles. One of them was particularly large and proved to be a small tumour. This consisted of: (1) long ducts similar to immature seminiferous tubules, and (2) large clear cells with large nuclei which were morphologically alike oocytes and were in places surrounded by an epithelium resembling that of the follicles of the bird's egg. F. W. R. B.

Tissue Cultures of Leucocytes with Tubercle Bacilli.—A. D. Timofejewsky and S. W. Benewolenskaja ("Explantationsversuche von weissen Blutkörperchen mit Tuberkelbazillen," *Arch. exper. Zellforsch.*, 1926, **2**, 31–42, 2 pls.). When cultivated in vitro with tubercle bacilli, granular leucocytes do not show any particular activity, while non-granular leucocytes phagocyte and digest the tubercle bacilli. The arrangement of the non-granular leucocytes round the tubercle bacilli and their subsequent behaviour and hypertrophy are similar to the well-known phenomena associated with the development of tubercles in living organism. This greatly favours the view that the so-called epithelioid cells arise in part at least from non-granular leucocytes, viz. have a hæmatogenous and not histiogenous origin. C. D. F.

B. INVERTEBRATA.

General.

On Vitelline Bodies.—P. Weiner ("Contribution à l'étude de noyaux vitellins (Tergenaria, Lithobius)," *Arch. Russes anat. hist. et embr.*, 1925–6, **4**, 37–72 & 153–64, 2 pls.). Investigations on the egg-cell of *Tergenaria domestica* and *Lithobius forficatus* chiefly by the method of Kolatschev-Nassonov. The vitelline nucleus of both species investigated consists of a substance the precise nature of which is not known but which is elaborated under the influence of Golgi bodies situated among its laminæ. Mitochondria may adhere to the vitelline nucleus but their contribution to its formation is, in any case, minimal. In the centre of the vitelline nucleus the centrosome is found.

C. D. F.

The Formation of Yolk in the Eggs of Polycirrus albicans Mgrn.—I. Messjatzev (*Arch. Russes anat. hist. embr.*, 1924–5, **3**, 409–20, 1 pl.). Yolk formation in this annelid can be subdivided into three stages of dechromatization of the nucleus, accumulation of lipoids, deposition of yolk. Dechromatization begins after nuclear reconstruction following the bouquet stage. At the same time the cytoplasm increases in size and assumes a filamentous appearance. It contains basiphil granules (chromidia) and mitochondria. The former accumulate next to the nuclear membrane of young oöcytes but disappear as these grow; the latter aggregate into rosettes having a mosaic-like arrangement close to the oöcyte membrane. Lipoids appear at the end of the dechromatization phase among the cytoplasmic filaments. Soon afterwards yolk spheres are seen each consisting of some protein surrounded by a lipoid film. The mechanism underlying these phenomena appear to be as follows:—The oöcytes absorb from the peritoneal cavity nutritive substances able to pass through their membrane, the selective property of which is, by and by, increased by the mosaic-like arrangement of the mitochondrial rosettes. The substances entered into the cytoplasm are transformed into simpler organic compounds which are, in part utilized as such, in part stored as lipoids, and in part absorbed into the nucleus. Here they undergo further elaboration into proteins and return to the cytoplasm while dechromatization is taking place and chromidia are seen externally to the nuclear membrane acting throughout the process as a dialyzer. The proteins elaborated by the nucleus form afterwards the central portion of the yolk spheres. C. D. F.

Protoplasmic Systems and Genetic Continuity.—E. B. Wilson (*Amer. Nat.*, 1925, **49**, 481–96, 3 figs). Investigations on the male germ cells of four genera of scorpions (Centrurus, Opisthacanthus, Vejovis and Hadrurus). Chondriosomes are variable, plastic and polymorphic forms assumed by a specific substance which is *per se* capable of extended and perhaps unlimited growth; which arises from a pre-existing substance of the same kind and is genetically continuous in successive generations of cells, but which is not definitely or permanently organized to form individualized units. The Golgi bodies too, consist of a specific and self-perpetuating material which is genetically continuous from one cell generation to another but is morphologically polymorphic and not very definitely organized into self-perpetuating structural units. C. D. F.

Non-Flagellate Sperms.—R. H. Bowen ("Further Notes on the Acrosome of the Animal Sperm. The Homologies of Non-flagellate Sperms," *Anat. Rec.*, 1925, **31**, 201–32, 5 text-figs.). The refringent body of the Ascaris sperm, the so-called capsule of the decapod sperm, and the honeycomb plates and valves of the myriapod sperm are homologous with the acrosome of the flagellate type of sperm. The acrosome can be regarded as a secretory product, the principal function of which is to initiate the physico-chemical reactions of fertilization.

R. J. L.

The Physiological Significance of Conjugation and Endomixis in the Infusoria.—L. L. Woodruff (*Amer. Nat.*, 1925, **49**, 225–49). Infusoria can reproduce indefinitely by fission under favourable environmental conditions. The fission rate shows in cultures a periodic rise and fall or rhythm which is due to some unknown factor in the cell metabolism but from which recovery is autonomous. Conjugation is designed to meet the emergency of physiological degeneration induced by unfavourable environmental conditions and profoundly stimulates the metabolic activities of the cell resulting in reproduction. Endomixis has for the species in which it occurs the same physiological significance as conjugation, viz. it wards off senile degeneration. C. D. F.

On Heterochromosomes.—B. TORELLI ("Il valore degli eterochromosomi," *Atti r. Acc. Lincei* (*Rend.*), 1925, **2**, 439–43, 1 fig.). In spermatogonia and spermatocytes of *Pamphagus marmoratus* and *Caloptenus italicus* the heterochromosome can be easily recognized during the resting phase as an extranuclear body. After pointing out that similar observations were previously made by Stevens in the spermatocytes of *Stenopelmatus* and by Brunelli in *Gryllus* and *Tryxalis*, the author comes to the conclusion that the element *x* is probably not a true chromosome. C. D. F.

Mollusca.

γ. Gastropoda.

Anatomy of Hendersonia: a Primitive Helicinid Mollusc.—H. B. BAKER (*Proc. Acad. Nat. Sci. Philadelphia*, 1925, **77**, 273–303, 4 pls.). Examination of the radula and operculum of *Hendersonia occulta* led the author to conclude in agreement with Wagner that this is the most primitive living example of the family, i.e. the most primitive living terrestrial mollusc, with the possible exception of *Bourciera*, an Ecuador form. This paper describes in detail the anatomy of the soft parts of specimens taken in Virginia. Retention of a right (prosobranch) auricle and a metamorphosed right kidney (provaginal apparatus) in both sexes, is held to show a more primitive condition than previous workers have reported in the Helicinidæ. On these characters it is argued that this form is not descended from Neritidæ. The uncinate form of the third lateral of the radula and the posterior position of both external ureteric openings are shared by most Helicinidæ, and point in the same direction. The markedly primitive characters found in Neritidæ are instances of retention due to habitat. The relationship of the Helicinidæ to the Pulmonata is considered.
E. W. B.

Physa zionis.—H. A. PILSBRY ("A Fresh-water Snail, Physa zionis, living under unusual conditions," *Proc. Acad. Nat. Sci. Philadelphia*, 1925, **77**, 825–28, 1 text-fig., 1 pl.). This is a new species of Physa found on patches of green algæ on wet rock faces, in Zion Canyon, Utah. It is a very small form, occurring well away from the stream, in which no molluscs are found. The internal anatomy is not described, but the radula is figured and is of the very distinctive Physa type. E. W. B.

Arthropoda.

α. Insecta.

The Œnocytes of Coleoptera.—J. KREMER ("Die Önocyten der Coleopteren," *Zs. mikrosc. anat. Forsch.*, 1925, **2**, 536–81, 17 text-figs. and 2 pls.). During the individual development of Coleoptera two generations of œnocytes (fat-body cells, gland-cells, *cérodécytes* of French authors) take place. The cells of both generations are characterized by their origin from fat cells and by a transformation of the fat granules of the cytoplasm into albuminoid globules which, on disruption of the cell membrane, dissolve in the body fluid. As shown by G. H. Bishop the disappearance of the fat and the appearance of the albuminoid material takes place under the direct influence of the nucleus which elongates and loosens its membrane, while its large basophil granules disperse throughout the cytoplasm where they abruptly change their reaction to nuclear dyes from basiphil to acidophil. The nucleus then re-forms without resuming its original oval shape. The œnocytes of the larval stage are very large, metamerically arranged and appear to be intimately related to the formation of the epidermal glands. The œnocytes of the imago are smaller, not arranged metamerically and are chiefly concerned with the storage of fat. C. D. F.

Nematohelminthes.

A Nematode causing Galls on Barley Roots.—T. GOODEY ("*Tylenchus hordei* Schøyen, a Nematode Parasite causing Galls on the Roots of Barley and other Graminiæ," *J. Helm.*, 1925, **3**, 193–202, 4 text-figs., 1 pl.). Most of the species belonging to the genus Tylenchus are microscopic worms parasitic on stem and stem appendages of plants. One member of the genus had been described by a Norwegian investigator, Schøyen, in 1885 as occurring in galls on the roots of barley which showed symptoms of disease due to the attacks of the parasite. His account of the anatomy of the worm was imperfect and there was even a doubt in the minds of some parasitologists as to whether such a worm existed especially as no further work on it had appeared since 1885. The present paper confirms and amplifies Schøyen's early account, filling in details of structure inadequately described by him and shows that *T. hordei* is a valid species. It also shows that in the structure of the œsophagus, the mouth stylet and the female and male genitalia the species possesses characters which place it definitely in the genus Tylenchus. Some experiments are recorded which show that the worm can set up galls on the roots of certain grasses as well as on barley. T. G.

Observations on Rhabditis hominis Kobayashi in the United States.—J. H. SANDGROUND (*J. Parasit.*, 1925, **11**, 140–48, 5 figs. on 1 pl.). The author deals with a very small nematode apparently identical with that described by Kobayashi in 1920 from the fæces of school children in Japan and considered by him as a human parasite. It is shown that the same worm occurs in America and the possibility of confusing its early larval stages with those of a *true* human parasite, *Strongyloides stercoralis*, is indicated and the differences from the larvæ of the latter are pointed out. It has been found in the fæces of dogs, rabbits, and rats but only when precautions were not taken to prevent the contamination of the fæces either by soil or by the possible visits of flies which can carry nematodes. All attempts to get the larvæ to infect human beings by mouth or by skin penetration failed and Sandground does not consider the worm to be a true parasite. T. G.

Development of a Nematode Parasite of the Horse.—R. J. Ortlepp ("Observations on the Life-History of Triodontophorus tenuicollis, a Nematode Parasite of the Horse," *J. Helm.*, 1925, **3**, 1–14, 9 text-figs.). The adults of this worm cause ulcerations of the colon. The author has studied the development of the larvæ which normally takes place in the droppings of the host and has described and figured these early stages. Records of experiments on the biology of the infective larvæ are also given. A description of the fourth stage larva which is parasitic within the host is provided, and there is an illustrated account of the manner in which the definitive mouth capsule is formed from vesicles which appear round the base of the provisional larval buccal capsule. T. G.

Studies on the Oxyurid Parasites of Reptiles.—G. S. Thapar (*J. Helm.*, 1925, **3**, 83–130, 132 text-figs.). The oxyurid parasites of reptiles are very numerous and are mostly small worms requiring detailed microscopic examination for the study of their structure. The author gives the results of a wide and thorough examination of three families comprising eight genera two of which are new. The figures are clear and many interesting details of anatomy are shown in the head structures, the various regions of the female genitalia and in the papillæ and tubercles associated with the spicules and accessory organs of the male tail. T. G.

Appendicitis and Oxyuris.—J. Verne ("Étude histologique d'un cas d'Appenditicite à Oxyures," *Ann. Parasit.*, 1925, **3**, 60–7, 4 text-figs.). The small nematode *Oxyuris vermicularis* has been incriminated by certain French parasitologists as a cause of appendicitis in human beings. This paper deals with a case in a boy of ten whose appendix, on removal, was found to show three nodosities within each of which on sectioning was found a little nest of young immature female *O. vermicularis*. Histologically, the appendix showed numerous excoriations of the mucosa with hæmorrhagic material filling the cavity in which the worms were living. There was a deep ulceration of the organ at one point. Eosinophilia and an intense plasmocytosis were also noted. T. G.

Ascariasis in Horses.—S. Hadwen (*J. Parasit.*, 1925, **12**, 1–10, 2 figs. on 1 pl.). Young colts were fed with embryonated eggs of *Ascaris equorum* and infections by the worm resulted. The larvæ migrated through the liver and lungs and in a very young animal set up severe coughing. Sections of the liver showed granular degeneration and accumulations of eosinophiles around and under Glisson's capsule. In the lung the eosinophiles were grouped under the pleura and between the lobes. On account of the incidence of the eosinophilia the author suggests that many of the larvæ migrate along the connective tissue outside the vessels as well as in the blood stream inside. Dead larvæ were found in the lungs surrounded by eosinophiles. It is suggested that in addition to the production of anti-substances to counteract the injurious products of the worms there is also a substance secreted by the eosinophiles which is detrimental to the worms. T. G.

Platyhelminthes.

The Cestode genus Mesocestoides, Vaillant.—T. W. M. CAMERON (*J. Helm.*, 1925, **3**, 33–44, 16 text-figs.). The author has studied the arrangement and relationships of the genitalia in the mature and gravid proglottides as revealed by stained material and has cleared up many previously obscure points. He shows that there is a common genital cloaca and not two apertures as considered by earlier writers. There is no uterine pore and there are two yolk glands and not one; the eggs also are typically tænioid in character. In all these points the worms show cyclophyllidian and not pseudophyllidian relationships. Two new species are described, viz. *M. mesorchis* and *M. cæstus*. T. G.

Rotatoria.

The Rotatorian Genus Colurella.—J. HAUER ("Zur Kenntnis des Rotatorien-Genus Colurella Bory de St. Vincent," *Zool. Anz. Leipzig*, 1924, **59**, 177–89, 7 figs.). A new species *Colurella gastracantha* is described and carefully figured. The salient character which has suggested the specific name is the presence on the ventral surface, yet within the slightly open edges of the lorica, of a long low keel (absent in some cases), terminating at the rear in a more or less sharp but short spine, which projects just beyond the lorica opening. A very small form with strongly laterally compressed lorica. Several other species of this interesting genus are figured, among them the very rare form *C. tesselata* (Glascott), which the author is able to add to the German Fauna-list. A key to facilitate the identification of the eleven species recognized is provided. D. B.

New or rare Rotifers from the Black Forest.—J. HAUER ("Lecane lauterborni n. sp. und einige für die deutsche Fauna neue Lecane- und Monostyla-Arten," *Zool. Anz. Leipzig*, 1924, **61**, 145–9, 1 fig.). In a series of excursions to the high-lying moors of the Black Forest, the Rotifers inhabiting mosses and especially Sphagnum have been collected and examined and the author has found that the Lecanidæ are strongly represented. He describes *Lecane lauterborni* n. sp. and gives details of eight other species new to the German Fauna. Among these are *Monostyla obtusa* Murray, *M. pygmaea* Daday, *Lecane amorpha* Harring, *L. ephestra* Harring, and *L. nana* (Murray). D. B.

Variation in Brachionus.—P. DE BEAUCHAMP ((I) "Sur l'apparition de la variation dans les conditions expérimentales chez les Rotifères du genre Brachionus." (II) "Sur la transmission de la variation chez les Rotifères du genre Brachionus," *C.-R. Acad. Sci.*, 1924, **179**, 1207–9; *ibid.*, 1290–1).

I. The genus Brachionus is pre-eminent among loricated Rotifers for the exceeding variability of the form, spines and ornamentation of the lorica. This has resulted in the description of a multitude of species of the closest relationship. It is believed that the majority of these are seasonal variations of a small number of leading types. With the object of testing the influence of diet on the variations of the lorica, de Beauchamp instituted a series of cultures, and reports the results obtained in one set of experiments on *Br. cluniorbicularis* Skorikov, generally considered as the ultimate form, without postero-lateral spines, of *Br. bakeri* Ehrbg. (*capsuliflorus* O. F. Müller), which has two such spines very long, and to be linked with it by intermediates with short postero-lateral spines. The *cluniorbicularis* can be reared indefinitely without on the whole the individuals being modified. But individuals frequently appear with short lower spines corresponding to the types *rhenanus* and *Entzii*, also analogous asymmetric forms with a spine on one side only. Whichever they may be, they emerge directly from the eggs of a female without lower spines. It has happened that all the eggs of such a female have produced individuals with lower spines, but most frequently the two forms appear irregularly.

II. Further instances are given in relation to the non-development, characteristic of *Br. cluniorbicularis*, of the postero-lateral spines. Whilst individuals with short spines occur here and there, the mutation is quickly effaced and is not established by selection. The appearance of arrhenotic females proceeds independently of the variation of the lorica and there is no parallelism in the two modifications. In none of the cultures have individuals been obtained with the long spines proper to *Br. bakeri*, and it is suspected that in spite of the alleged continuity of natural intermediaries, those forms, which differ from the preceding in other characters of the lorica and of the shell of the resting egg, belong in reality to a species actually distinct. In any case *Br. bakeri* has a different ethology. It only occurs in spring, and de Beauchamp has been unable to rear it indefinitely. D. B.

Rare Rotifers and Entomostracans in Russia.—M. S. IDELSON ("O nekotorykh interesnykh formakh iz grupp rotatoria i cladocera naidennykh b okrestnostiakh Kosinskoi Biologicheskoi Stantsii," *Trudy Kosinskoi Biolog. Stantsii*, 1925, 69–76, 1 text-fig.). The three rare rotifers, *Cupelopagis vorax* (Leidy), *Dinocharis intermedia* Bergendal, and *Monostyla monostyla* (Daday), have been found in the vicinity of the Biological Station at Kossino, the last-named having hitherto been known only from German New Guinea, Paraguay and North America It is stated that *Cupelopagis vorax* frequently captured young *Chydorus sphaericus*, but also fed upon Diatoms, Chlorophyceæ and Cyanophyceæ. The occurrence of the two rare Cladocerans *Scapholeberis microcephala* Lilljeborg and *Acantholeberis curvirostris* O. F. Müller is likewise noted. D. B.

The Microfauna of Transcaucasian Lakes.—N. N. FADEEV ("K svedeniiam o faune ozer Zakavkazia," *Raboty Severo-Kavkazskoi Hidrobiol. Stantsii pri Gorskom Selsko-Khoziaistvennom Institute*," 1925, 1, 17–26, 2 pls.). The author lists the organisms found in collections made by B. Vinogradov and S. Tchernov in 1925 in two lakes in Georgia and one lake in Armenia. Amongst other forms he records the occurrence of the very rare Rotifers *Lecane tenuiseta* and *Monostyla monostylæformis*, and describes four new varieties of *Brachionus plicatilis*, viz. var. *longicornis*, var. *decemcornis*, var. *ecornis*, and var. *murrayi*.

Among Entomostraca, *Diaptomus acutilobatus* and *Moina microphthalma* are specially noted. D. B.

New Rotifers in Russia.—N. N. FADEEV ("Materialen zur Rotatorienfauna des S.S.S.R. Kurze Diagnosen neuer Rotatorien der russischen Fauna," *Russ. Hidrob. Zhurn.*, 1925, **4**, 72–6, 1 pl.). The author describes five new rotifers found in the government of Kharkow—viz. *Pleurotrocha multispinosa* n. sp., which has numerous short prickles, mostly disposed in rows near the head and near or on the foot; *Pseudoharringia similis* nov. gen. and n. sp., which has relationship with *Enteroplea lacustris* and with *Harringia eupoda*; *Lepadella heterodactyla* n. sp., with toes of differing form; *Voronkowia mirabilis* nov. gen. and n. sp., assigned to the Order *Flosculariaceæ*, but without a case, and a free-swimmer; and *Filinia aseta* n. sp., which has no leaping spines D. B.

The Revivication of Rotifers.—N. N. PLAVILSHCHIKOV ("Zametki ob anabioze u kolovratok (Rotatoria). I. Anabioz u Philodina roseola," *Russ. Hidrob. Zhurn*, 1925, **4**, 98–102). The author has during 40 months been studying the conditions under which *Philodina roseola* is capable of revivication after prolonged periods of desiccation by laboratory methods. He has formed the opinion (and thinks that his experiments afford partial confirmation), that the successful results of the test depend in some measure upon the age of the rotifers employed. Where a number of individuals of equal age were dried, the percentage which revived was greater and more regular than when individuals of varying age were selected for the test. In a separate experiment, individuals which had been dried and kept for six months in hydrogen gas revived when moistened, proving that no exchange of gases and no oxidation process had been operating during the period. D. B.

Rare Rotifers from the West Coast of Sweden.—J. RUNNSTRÖM ("Synchæta neapolitana Rousselet und S. littoralis Rousselet von der schwedischen Westküste," *Ark. Zool.*, 1926, 18 A. No. 17, 1–5). To the marine species of the genus Synchæta already known to inhabit Swedish waters Runnström adds two more, viz. *S. neapolitana* and *S. littoralis*, which he has found near the Swedish Zoological Station at Christineberg at the mouth of the Gulmarfjord. Of *S. littoralis* only one example was seen, in July, 1925, but *S. neapolitana* was met with in great numbers in August and September, 1917, and again in July, 1925. Opportunity was thus given to study its characteristic manner of swimming, which combines a continuous rotation of the body on its long axis, to right or to left at will, with a forward movement either coincident with the body axis or varying to a spiral movement, when the body is inclined to the axis of direction, the toes remaining in that axis while the head travels in a spiral curve. The temperature and the salt content of the water are compared with those on record for the month of June in the Gulf of Naples where this species was discovered in 1897 and where it has repeatedly been seen in later years in that month, and the conclusion is drawn that in these respects *S. neapolitana* can endure a considerable variation. D. B.

A New Rotatorian Genus.—N. N. Fadeev ("Über eine neue Rotatoriengattung (Metadiaschiza mihi)," *Zool. Anz.*, 1925, **62**, 133–8, 2 figs.). Having frequently found in Russia the very rare Rotifer described by Rousselet as *Diplois trigona*, the author had opportunity to closely examine its structure, and states that in the build of the lorica and in the form of the mastax, &c., it shows strong relationship with the genus Diaschiza, and has little affinity with the genus Diplois of the family Euchlanidæ. He therefore proposes a new genus, Metadiaschiza, characterized mainly by its fully developed lorica, to include this species and also, doubtfully, *Diplois sculpturata* Daday, a form which seems to require further study. He assigns the new genus to the family Diaschizidæ Sachse. D. B.

The Variation of Brachionus forficula. - N. N. Fadeev ("Das Rädertier Brachionus forficula Wierz. und seine Varietäten," *Zool. Anz.*, 1925, **64**, 285–93, 2 figs.). The author has studied the variations in size and form of *Br. forficula* Wierz., which has an extended distribution, ranging from the R. Wolga (Kostroma) in the north to Victoria Nyanza and Ceylon in the south, but has been mostly recorded from South Russian localities. He considers that *Br. caudatus* Apstein is a variety and names it *B. forficula* var. *apsteini*. The var. *laevis* Apstein is accepted and other variations are designated as *formæ*, viz. *f. minor* (Voronkov), *f. volgensis* (Skorikov), *f. divergens* Fadeev and *f. voronkovi* Fadeev D. B.

Rotifers Parasitic in the Gill Cavities of Crayfish.—J. Hauer ("Drei neue Lepadellaarten aus den Kiemenhöhlen des Flusskrebses," *Arch. Hydrobiol.*, 1926, **16**, 459–64, 3 figs.). In material obtained from the gill cavities of crayfish fished from the lakes and streams in the vicinity of the Biological Station at Plön and other North German waters, Hauer has found three species of Lepadella, viz. *L parasitica* n. sp., *L. astacicola* n. sp., and *L. branchicola* n. sp. In all three the lorica is rather deeper than in the common free-living forms, but the most striking detail of their structure is that the toes in each species are fused together for about half their length, a character only hitherto observed in *L. borealis* Harring and perhaps in *L. pygmaea* (Gosse) if the meagre description of the latter is accurate. All other Lepadellæ known have two distinctly separate toes. One or other of the species was found in nearly every sample of material. D. B.

Protozoa.

Motion of Flagella.—B. J. Krijgsman ("Beiträge zum Problem der Geisselbewegung," *Arch. Protistenk.*, 1925, **52**, 478–88, 6 text-figs.). Working on *Monas sp.* the author analyses the motions of the flagella used in forward, backward and lateral movement and in turning round. He concludes that the flagellum acts as a rudder, as described by Ulehla. The motion of the flagella is occasionally arrested but this is not due to abnormal conditions. S. D. K.

A New Species of Herpetomonas.—R. Poisson ("Un nouvel Herpetomonas cœlomique : Herpetomonas Mercieri n. sp., parasite de la cavité générale des larves de Simulium reptans L.," *Arch. zool. expér.* (*Notes et Revue*), 1925, **64**, 57–62, 2 text-figs.). This parasite, which occurs abundantly in the cœlomic cavities of *Simulium reptans* larvæ, differs from *H. similæ* (parasitic in the imago of *S. columbaczense*) in its smaller size and cœlomic habitat. There is considerable variation in shape, and amœboid Leishmania forms are also recorded. Internal structure also varies; in typical Herpetomonas forms, the flagellum, with its basal granule, is inserted some distance from the nucleus, while in *Crithidia* forms it is inserted near the nucleus, and has a small undulating membrane attached to its base. The blepharoplast may be near or apart from the point of insertion of the flagellum. In some forms the nucleus is large and the blepharoplast small, in others the nucleus is rudimentary and the blepharoplast large, but no conjugation between these forms has been observed. Multiplication by longitudinal fission and rosette formation is described. S. D. K.

Lophomonas blattarum.—R. Kudd ("Observations on Lophomonas blattarum, a Flagellate Inhabiting the Colon of the Cockroach, Blatta orientalis," *Arch. Protistenk.*, 1926, **53**, 191–214, 2 pls., 4 text-figs.). The flagella of *Lophomonas blattarum* pass down to a single ring of blepharoplasts, and are continued below these as fine axial filaments. These form the calyx enclosing the nucleus, and unite below this to form the axostyle. The parabasal apparatus is not homologous to that of other flagellates, and is interpreted as a protective structure for the nucleus. In binary fission one end of the blepharoplast ring becomes attached to the nucleus and breaks off; this elongates, forming the paradesmose; the nucleus also elongates, spindle fibres develop parallel to the paradesmose, and the 6–8 chromosomes divide. The paradesmose divides in the middle. The outer ends form two new rings of blepharoplasts and the axial filaments ot the calyx, while the inner halves form the axostyles. The parabasal apparatus is formed *de novo*. The old calyx and flagella are absorbed or cut off, and cell division takes place. Nuclear division in the cysts is of the same character, but in the second cyst division only three chromosomes are usually present. Multiple fission has not been observed. The anterior part of the body, with the nucleus and parabasal apparatus, may break off from the cytoplasm, which then degenerates. Food is taken in at almost any point. S. D. K.

Cytoplasmic Inclusions in Pyrsonympha vertens.—O. Duboscq and P. Grassé ("Notes sur les protistes parasites des termites de France. Appareil de Golgi, mitochondries et vésicules sousflagellaires de Pyrsonympha vertens Leidy," *C.-R. Soc. biol.*, 1925, **93**, 345–7, 7 text-figs.). *Dinenympha gracilis* is the young stage of *Pyrsonympha vertens*. The Golgi apparatus consists of separate dictyosomes, applied to the nuclear membrane, posteriorly in young forms, and all around in later stages. Mitochondria are scattered rodlets, often seen dividing. A regular series of nucleus-like vesicles occurs under each undulating membrane. These are homologized with the chromatic granules of *Cryptobia* and *Trichomonas*. S. D. K.

Trichodina steinii (C. and L.) from Planaria polychora (O. Schm.)—W. A. KEPNER and A. L. PICKENS (*Biol. Bull.*, 1925, **49**, 237–40, 1 text-fig.). The authors point out a close homology in anatomical details between Trichodina and the allied genus Vorticella. In correlation with its ectozoic habit *T. steinii* has undergone a reversal of polarity involving the position of the nuclei and causing it to creep and swim with the peristome directed backwards. S. D. K.

Giardia Simoni (Lavier).—O. NIESCHULZ and B. J. KRIJGSMAN ("Ueber Giardia simoni Lavier," *Arch. Protistenk.*, 1925, **52**, 166–9, 2 curves and 1 text-fig.). The occurrence of *G. simoni* in a white rat and in *Mus norvegicus*, both from Holland, is noted. The parasite is described and compared with *G. muris*; the authors' observations on the parabasal body do not agree with the original description given by Lavier. S. D. K.

Structure and Nuclear Division of Amœba Unduligrada nov. sp.—H. RAABE ("Amœba unduligrada sp. nov. Structure de l'amibe et division du noyau," *Arch. zool. expér.*, 1925, **64**, 327–51, 2 pls., 1 text-fig.). This amœba is rounded and moves rapidly by large semilunar pseudopodia. It has no distinct membrane, but a thick ectoplasm. The indistinctly alveolar endoplasm contains refractive granules which are lost after fixation, metachromatic granules (volutin), and small round mitochondria. The nucleus is alveolar throughout with an outer clear zone; inside this there is a chromatic zone with chromatin situated in the meshes between the alveoli; inside this again is another clear zone, surrounding a central mass in which chromatin is distributed as in the outer chromatic zone. Mitosis begins by division of the central mass, in which two centrioles appear temporarily; the division of the other parts follows. In the central zone, and apparently also in the rest of the nucleus, the number of alveoli is doubled before division, each daughter nucleus having the same number as the parent nucleus. Stages resembling the beginning of mitosis are described; the peripheral chromatin divides to two masses, connected by a centrodesmose and with the central chromatin lying between them. S. D. K.

Temperature and Locomotion Rate in Amœba.—A. M. SCHWITALLA ("The Influence of Temperature on the Rate of Locomotion in Amœba. II. The Rate of Locomotion in Amœba at Different Temperatures," *J. Morph. Physiol.*, 1925, **41**, 45–58, 1 chart). If amœbæ are kept under observation for some time their average rate of locomotion is greater at higher temperatures than at lower. At temperatures above 25° C., however, the rate decreases. Immediate response to alteration of temperature is very variable, probably because the amœbæ are in different phases of the rhythm exhibited in their ordinary rate of locomotion. S. D. K.

Myxobolus notatus.—P. DEBAISIEUX ("Études sur les myxosporidies. III. Myxobolus notatus Mavor." *Arch. zool. expér.*, 1925, **64**, 353–85, 2 pls. and 2 text-figs.). This parasite, found in subcutaneous tumours on the fish *Leuciscus rutilus*, is almost certainly identical with Plehn's *M. piriformis*. The tumours contain encysted plasmodia, each surrounded by a radially striated zone, outside which is a layer of epithelium. Spore formation takes place in the plasmodium. It contains many vegetative nuclei, which divide by amitosis; they are seen in pairs, and probably fuse to form the nucleus of the propagative cell. This divides mitotically several times giving rise to uninucleate cells. The nucleus of each daughter cell buds off a small sporocyst nucleus, and the binucleate cell is a sporocyte. The nucleus of the sporocyte divides mitotically, one daughter cell having one nucleus, the other a sporoblast and a sporocyst nucleus. Two such binucleate cells fuse to form the pan-sporoblast. Division of the sporoblast nuclei in the pan-sporoblast takes place, but the details of these stages have not been worked out. Eventually each pan-sporoblast gives rise to two spores, which have each a single polar capsule and a flat expansion which disappears on fixation. Each contains a binucleate amœboid germ. Free plasmodia are present in the tissue surrounding the cyst; in some of these the nuclei are associated in pairs. Some are seen breaking up into smaller forms, which probably spread infection in the host. No sexual differentiation has been observed. S. D. K.

Lipoids and Fats of Sporozoa.—PH. JOYET-LAVERGNE ("Sur les lipoïdes et les graisses des sporozoaires," *C.-R. Acad. Sci.*, 1925, **180**, 335–7). Lipoids allied to the lecithin group, and neutral fats, occur in Sporozoa. In *Aggregata Eberthi* lipoid granules are present in the cytoplasm of the gamonts; in both sexes these enlarge, and their osmiophility increases, as the gamont grows. In the macrogametocyte they become vesicular, and then alter to neutral fat, which is found in the fertilized macrogamete. In the microgametocyte they remain in the lipoid phase and are left in the residuum when gametes are formed. One mass of fat from the zygote passes to each sporoblast, and breaks up at the formation of the sporozoites. In *Nina gracilis* lipoids are present in the protomerite and deutomerite of the cephaline. In the microgametocyte these behave as in Aggregata; in the macrogametocyte they are larger and more numerous and some become transformed into fats. A rich development of fats is characteristic of the female sex.

S. D. K.

Mitochondria and Sex Differentiation in Sporozoa.—PH. JOYET-LAVERGNE ("Sur le chondriome des sporozoaires et la sexualisation du cytoplasme," *C.-R. Soc. biol.*, 1925, **92**, 1425–6). A study of mitochondria in *Nina gracilis*, *Gregarina polymorpha*, *G. cuneata*, *Steininia ovalis*, *Stylorhynchus longicollis*, *Adelina dimidiata* and *Aggregata Eberthi*. In the young stages the mitochondria are granular and distributed throughout the cytoplasm with the exception of the anterior end. This state is retained longer in Gregarines than in Coccidia, the epimerite and anterior end of the protomerite, being free of mitochondria. Rod-like and filamentous mitochondria appear in the later stages, being latest in Gregarines. The mitochondria of the male are more deeply staining, more numerous, richer in phosphorus and basophil even in forms apparently isogamous than those of the female which are weakly oxyphil, less numerous and difficult to stain.

S. D. K.

Sex Differentiation of the Cytoplasm in Gregarines.—PH. JOYET-LAVERGNE ("Les caractères cytoplasmiques de la sexualité dans les grégarines," *C.-R. Acad. Sci.*, 1924, **179**, 1212–4). In *Nina gracilis* and *Stylorhynchus longicollis* the mitochondria show the usual sex differentiation in the gametocytes. In the latter the paraglycogen spheres and albuminoid reserves are larger in the female than in the male, the Golgi bodies being most numerous in the male. In Nina some of the albuminoid reserve granules undergo changes in both sexes; in the male they become basophil while in the female they remain oxyphil, and show an approach to vitellus in their characters. In the female they later enlarge, become impregnated with neutral fat and surrounded by vacuoles. The grains of paraglycogen shrink during this process, and later enlarge again, while the vitelloid masses shrink. In the young macrogamete, one of the vitelloid vacuoles and several paraglycogen spheres are present at one end of the nucleus. The paraglycogen spreads outward and the vacuole divides repeatedly, thus imparting the alveolar appearance to the cytoplasm of the ripe macrogamete. S. D. K.

Golgi Apparatus of Gregarine Sporozoites.—PH. JOYET-LAVERGNE ("Sur l'appareil de Golgi des sporozoïtes de grégarines," *C.-R. Soc. Biol.*, 1925, **92**, 1185–7). In *Steinina ovalis* the Golgi apparatus of the young sporozoites is an axial rod, which later thins out and forms a group of granules at the anterior end, in the future protomerite. Golgi elements also surround the nucleus and two short rods are present at the anterior end. In *Steinina ovalis* the young sporozoites have two axial Golgi crescents, later forming rows of granules, and the two anterior Golgi rods noted in *Steininia.* In intraepithelial forms the Golgi elements are scattered, and later some collect near the nucleus. In *Stylorhynchus longicollis* the Golgi bodies of the young cephaline are in the future epimerite, a few also being scattered, and some juxtanuclear. Golgi bodies are always distinct from mitochondria in sporozoa; those of gregarines are analogous to those of coccidia in similar stages, both groups showing polarization of the Golgi apparatus in the cell, rapid development of this apparatus in the young stages, a change of the Golgi elements from rodlets to granules, and, in the sporozoite and microgamete, anterior rods or granules comparable to the metazoan acrosome. S. D. K.

Alveoline and Cytoplasmic Structure in Sporozoa.—PH. JOYET-LAVERGNE ("Sur l'alvéoline et la constitution du cytoplasme dans les sporozoaires," *C.-R. Soc. biol.*, 1925, **92**, 1427–8). In young Gregarines the anterior lens-shaped area of the protomerite is formed of an albuminoid substance, which is also diffused through the cytoplasm, forming a kind of fundamental protoplasm (paleoplasm). The mitochondria and this substance coagulate on fixation, forming the alveoline of Frenzel, which bounds the cytoplasmic alveoli. These are proportional in size to the reserve granules. Alveolar structure appears due to the pressures exerted by these granules on the fluid around them. In *Aggregata Eberthi*, Dobell's glycogen was not noted, and his chromatin-like granules probably correspond to the albuminoid reserve granules. S. D. K.

Sex Differentiation and Gamete Formation in a Gregarine.—Ph. Joyet-Lavergne ("De l'influence de la sexualisation du cytoplasme sur la genèse des gamètes d'une grégarine," *C.-R. Soc. Biol.*, 1925, **93**, 8–9). In *Nina gracilis* the nuclei of the male in the second stage of encystment have stronger and more varied staining affinities than those of the female, but develop along parallel lines in both sexes until acted on by cytoplasmic influences. In the male the nuclei remain at the surface, surrounded by mitochondria, Golgi bodies, paraglycogen, lipoids, and albuminoid reserve materials. In the female the chief difference lies in the presence of large vitelloid masses, which have an attraction for the nuclei; all the reserve materials become concentrated centrally, the nuclei also migrating, and applying themselves each to a vitelloid mass. This association is the initial cause of the formation of a female gamete. The vitelloid mass becomes surrounded by a vacuole which, with the nucleus, attracts some of the cytoplasmic inclusions. A membrane, which is then produced around this mass, forms the boundary of the future macrogamete. S. D. K.

Lipoids and Sex Differentiation in Sporozoa.—Ph. Joyet-Lavergne ("Sur l'évolution des lipoïdes et la sexualisation de cytoplasme dans les sporozoaires," *C.-R. Acad. sci.*, 1925, **180**, 1074–6). Lipoid evolution is intimately connected with sex specialization of the cytoplasm in Sporozoa; in *Nina gracilis* and *Aggregata Eberthi* lipogenesis in the female is related to a reducing quality in the cytoplasm, causing discoloration of methylene blue. In *Gregarina polymorpha* the primite (female) has more numerous and more osmiophile lipoid granules than the male. In *Adelina dimidiata* lipoid vesicles are scattered in the cytoplasm in young gametocytes; in the male they remain unchanged, while in the female a few of them enlarge and develop into fat; the rest collect in a juxta-nuclear mass, coinciding with the Golgi apparatus and following its migrations. The Golgi bodies in these stages cannot be distinguished from the lipoid granules when both are preserved, a fact which possibly indicates that the latter are derived from Golgi bodies, which thus become less numerous in the female. S. D. K.

Porosporids and their Evolution.—L. Leger and O. Duboscq ("Les Porosporides et leur évolution," *Trav. stat. zool. Wimereux*, 1925, **9**, 126–39, 1 pl., 1 text-fig.). These Gregarines pass the earlier stages of their life cycle in decapod Crustaceans, and the sporogonous stages in Lamellibranchs. Five species are recognized in Crustacea: *P. gigantea* (van Beneden, 1869), *P. sp.* (Leger and Duboscq, 1911), *P. portunidarum* (Frenzel, 1885), *P. Legeri* (de Beauchamp, 1910), and *P. maraisi* (Leger and Duboscq, 1911). *P. pisæ* (Leger and Duboscq) probably belongs to a different genus; no gymnospores have been observed in its life cycle. Spores of this genus are described in many Lamellibranchs, but, except in the case of *P. portunidarum*, cannot be connected with stages in a Crustacean host. Three species are known from spores only: *P. veneris* from Venus fasciata, *P. galloprovincialis* from Mytilus galloprovincialis, and *P. pectinis* from Chlamys varia. The cycle in the Crustacean host comprises the growth, association and encystation of the sporozoites and the subsequent production of gymnospores in the cysts. Single individuals may also become encysted. Gymnospores enter the Lamellibranch with the respiration current, and release their constituent germs in epithelial cells. By subsequent stages, not yet described, these give rise to sporoblasts, each growing into a spore with a single sporozoite. Epithelial cells of the intestine, buccal palps, mantle, and branchial filaments act as phagocytes, engulfing the gymnospores as they pass. S. D. K.

Cytoplasm of Sporozoa.—P. M. JOYET-LAVERGNE ("Recherches sur le Cytoplasme des Sporozoaires," *Thèse*, 1925, pp. 1–128, 28 text-figs. and 1 pl., Masson et Cie, Paris). No fundamental difference in cytoplasmic structure exists between coccidia and gregarines. In both groups mitochondria are granular in early stages, later developing into rods and chains. The absence of mitochondria at the anterior end of Gregarina is due to its relations to the host cell, similar conditions being only found in the coccidian sporozoite. The Golgi apparatus is always distinct from mitochondria. In *Aggregata Eberthi* it lies near the nucleus in the schizont; in the schizozoites it is first crescentic, then rod-shaped; the rod splits and breaks into granules in the antenuclear vacuole. In the young gamont the apparatus is first perinuclear, then scattered and then collects again near the nucleus. In the microgametocyte the Golgi elements pass out to the surface and penetrate the microgametes when these are formed. In the macrogamete the apparatus is juxtanuclear until after fertilization, when it fragments, penetrating the sporoblasts. A single Golgi body is found in each spore, and later shared between the sporozoites. Acrosome-like Golgi bodies are described at the anterior end of the sporozoite and microgamete, in this and other forms. The Golgi apparatus is also described in *Nina gracilis*, *Steinina ovalis*, and *Adelina dimidiata*. Paraglycogen is present in both groups, the amount found in different stages varying inversely with the amount of lipoids and fats. Paraglycogen granules pass from the schizont into the merozoites. In the microgametocyte they are left in the residuum on the formation of microgametes, but in the macrogamete paraglycogen persists until after fertilization, when it is used up. In Aggregata these granules can be traced from the sporoblasts to the spores and sporozoites. Lipoids and fats may be present in a diffuse condition in early stages. The presence of sporozoan parasites causes increased secretion of lipoids in the surrounding intestinal cells. In gregarines these lipoids are absorbed by the anterior clear part of the protomerite, and rebuilt into lipoid granules just posterior to this zone. In coccidia the process cannot be followed. Albuminoid reserves are seen in the schizonts, gametocytes, and macrogametes of both groups. They are related to a section of mitochondria, a mitochondrial rod being applied to each granule. These granules arise by budding from the nucleolus, and the basophil edge described as a mitochondrial element is present while they are still intranuclear.

S. D. K.

BOTANY.

(*Under the direction of* DR. A. B. RENDLE.)

GENERAL,

Including the Anatomy and Physiology of Seed Plants.

Cytology,

Including Cell-Contents.

Continuity of Protoplasm in Endosperm-cells.—E. QUISUMBING ("Continuity of Protoplasm in Endosperm-cells of *Diospyros*," *Bot. Gaz.*, 1925, **58**, 439–49, 2 pls., 2 figs.). In *D. discolor* and *D. Ahernii* protoplasmic connections in the endosperm-cells are visible without the use of stains. Heidenhain's iron-alum-hæmatoxylin in conjunction with gold-orange in clove-oil is the best combination of stains, the walls taking the orange-stain and the protoplasmic strands becoming dark bluish-brown. Safranin-gentian-violet stains are also satisfactory. The nature of the protoplasmic connections varies in the different species. In *D. discolor* and *D. Ahernii* they are numerous and perforate the unpitted cell-walls; in *D. Kaki* and *D. ebenaster* they are few and restricted to groups. They may be single or in groups of two, three, four, five or six, and are usually thinner when in groups than when solitary. S. G.

Structure and Development.

Reproductive.

Development of Asparagus Seed.—W. W. ROBINS and H. A. BORTHWICK ("Development of the Seed of *Asparagus officinalis*," *Bot. Gaz.*, 1925, **58**, 426–38, 43 figs.). At the time of pollination the inner integument has a thickness of two cells and the outer integument of five to ten cells; within sixteen days the seed-coat has attained its maximum thickness. Subsequently there is progressive desiccation and shrinkage, and the outer surface of the epidermis acquires a hydrophilous membrane which probably facilitates the absorption of water. By the thirtieth day the two fatty membranes are closely compressed and are usually indistinguishable. The cells of the nucellus attain their maximum development about the sixteenth day, after which they are gradually disorganized and absorbed. Within a month the nucellus is reduced to a very thin structureless layer. The endosperm is at first represented by free nuclei in the neighbourhood of the micropyle; by the thirteenth day wall-formation has begun, and by the twenty-first day the embryo-sac is completely filled with endosperm. The latter is not homogeneous in structure and chemical constitution; between the root-tip and the seed-coat it is rich in pectic material, which appears to be advantageous to the growing embryo at the time of germination, ince it absorbs water readily and is easily penetratd by the root-tip.

About a month after pollination the endosperm is in various stages of disorganization. About ten days after pollination the embryo is composed of a few cells together with a massive, irregular suspensor of the *Lilium* type. The suspensor elongates and pushes the growing embryo into the embryo-sac. By the second week the embryo is surrounded by endosperm, and by the fourth week it is of considerable size and has become free of the nucellus. Owing to elongation of the cotyledon the mature embryo occupies almost the entire length of the seed. During germination the cotyledon remains in the seed in close contact with the endosperm, and thus acts as an absorbing and conducting organ. The mature seed has a seed-coat consisting of a single layer of epidermal cells, the outer wall of which is thick and the inner thin. Beneath the epidermis are highly compressed cells, and under these is a suberized membrane. The bulk of the seed is composed of endosperm in which is embedded a slender, thread-like embryo differentiated into root with root-cap, short hypocotyl, stem growing-point and elongated cotyledon.
S. G.

CRYPTOGAMS.

Pteridophyta.

Calamostachys.—ISABEL M. P. BROWNE ("A Note on *Calamostachys tuberculata* Stbg.," *New Phytologist*, 1925, **24**, 305–8). A résumé of what is known about the fossil cones and axes of this species of *Calamostachys*, together with the results of the author's own examination of Renault's original specimens preserved in the Paris Museum of Natural History.
A. G.

Fossil Plants.—T. M. HARRIS ("Note on a New Method for the Investigation of Fossil Plants," *New Phytologist*, 1926, **25**, 58–60). A method devised for the extraction of the more resistant plant remains from the shales in which they are embedded. Briefly, the rock is immersed for some days in strong nitric acid with 5 p.c. of potassium chlorate; then thoroughly washed, and placed in dilute sodium hydroxide. The plant fragments liberated are finally cleaned with 25 p.c. hydrofluoric acid. They then consist of cuticle alone, or, maybe, some of the softer tissues also. For the softer rocks this process is more convenient than the hydrofluoric acid method employed by Walton for extracting bryophyte remains from hard sandstones.
A. G.

Ophioglossum.—T. D. A. COCKERELL ("The supposed Fossil *Ophioglossum*," *Torreya*, 1926, **26**, 10, 11). Further discussion of the fossil plant from the Eocene of Wyoming described by the author. Criticism has shown it not to be an *Ophioglossum*; nor is it a *Danæa*. It is congeneric with *Xantholithes* in the Washington Museum. Possibly it may be an extinct type of marine alga.
A. G.

Lycopodineæ of Quebec.—FRÈRE MARIE-VICTORIN ("Les Lycopodinées du Québec et leurs formes mineures," *Contrib. Lab. Bot. Univ. Montréal*, 1925, No. 3, 1–121, 12 figs.). This monograph of the clubmosses of Quebec is companion to a similar work on the Filicineæ

(1923) by the same author. It contains 11 species of *Lycopodium*, 4 of *Isoëtes*, and 3 of *Selaginella*, with many varieties and forms, several of them proposed for the first time. The first part of the work is a revision and full discussion of the various plants treated in the monograph. And the second part is more strictly systematic, and contains keys, descriptions and distribution. A. G.

Ecology of Pellæa.—F. L. PICKETT and MILDRED E. MANUEL (" An Ecological Study of certain Ferns : *Pellæa atropurpurea* (L.) Link and *Pellæa glabella* Mettenius," *Bull. Torrey Bot. Club*, 1926, **53**, 1–5, 4 figs.). The above-mentioned ferns are xerophytic. Their success in life seems to be due to three factors : the ability of their gametophyte to survive extreme drought ; its power of renewed growth in the production of secondary prothallia ; its production of sporophytes apogamously. An account is given of the experiments made to test these characteristics. A. G.

Ferns from New Caledonia.—CARL CHRISTENSEN (" Filices neocaledoniæ," *Vierteljahrsschrift Naturforsch-Gesells. Zürich*, 1925, **70**, 221–4). Descriptions of five new species and a variety of ferns collected by J. Franc in New Caledonia, with critical notes on their characteristics and affinities. A. G.

Bryophyta.

Barbula inermis in Belgium.—A. CORNET (" Note sur la Découverte du *Barbula inermis* C. Muell. en Belgique," *Bull. Soc. Roy. Bot. Belg.*, 1925, **58**, i., 8). This species was recently recorded as new to Belgium ; but as a fact it had been gathered in the Vesdre (Weser) valley by Halin many years ago, and again in 1903 by Cornet. A note on the characters of the moss is added. A. G.

Cynodontium in Belgium.—A. CORNET (" Note sur une Mousse nouvelle pour la Belgique," *Bull. Soc. Roy. Bot. Belg.*, 1925, **58**, i., 27). A moss gathered in Belgium in 1902 closely resembles *Cynodontium gracilescens*, but unfortunately lacks the fructification. It resembles *C. polycarpum*, but differs in several points indicated. A. G.

Ingham Collection of Mosses.—ANONYMOUS (*New Phytologist*, 1925, **24**, 312). A note on the nature of the contents of the collection of British mosses and hepatics of the late William Ingham, the compiler of the Census Catalogue (York, 1907) of these plants. It is now the property of Leeds University and contains 12,000 specimens. A. G.

Thallophyta.

Algæ.

Marine Phytoplankton.—BLODWEN LLOYD (" Character and Conditions of Life of Marine Phytoplankton," *J. Ecology*, 1926, **14**, 92–110, 5 figs. in text). The contents of this paper are as follows : Introductory ; Chief Organisms of the Phytoplankton (Diatoms, Dinoflagellata, Protophyta, &c.); Biology of the Phytoplankton (Periodicity, Reproduction, Nutrition); External Conditions (Light and Depth, Temperature, Winds, Tides and Currents, Salinity and Rainfall); Evolution of the Plankton Diatom Form (Typical Diatom forms—widely distributed species; Residual Plankton forms—less abundant; Reversionary Plankton forms). A. G.

Algæ of Latvia.—H. SKUJA ("Vorarbeiten zu einer Algenflora von Lettland. I.," *Acta Horti Bot. Univ. Latviensis*, 1926, **1**, 33–54, 4 pls.). A preliminary account of the results of several years' investigation of the freshwater algæ of Latvia, comprising 122 Flagellatæ and 20 Dinoflagellatæ, 104 of which constitute new records for the country. The novelties are two species and two varieties. A. G.

Freshwater Dinoflagellatæ of Poland.—JADWIGA WOLOSZYNSKA (Beiträge zur Kenntnis der Susswasser-Dinoflagellaten Polens," *Acta Soc. Bot. Poloniæ*, 1925, **3**, 49–64, 6 figs.). An account of nine winter forms of Dinoflagellatæ, two of which are new species of *Gymnodinium*. The structure of *Hemidinium nasutum* is closely studied. A. G.

Flagellatæ of the Congo.—PAUL VAN OYE ("Flagellates du Congo Belge," *Bull. Soc. Roy. Bot. Belg.*, 1925, **58**, i., 11–19, figs. in text). A list of 36 species, in 12 genera, collected in the Belgian Congo, for which no Flagellatæ have hitherto been recorded. The table of distribution shows that they came mostly from artificial lakes; and nine of them have been collected but once previously. Three new species are described and figured. A. G.

Trachelomonas hispida.—B. W. SKVORTZOW ("On *Trachelomonas hispida* (Perty) Stein and its Varieties," *New Phytologist*, 1925, **24**, 299–305, 1 pl.). Short descriptions and figures of all the known varieties of *Trachelomonas hispida*, a green flagellate alga of the family Eugleninæ. Of the 17 varieties described 6 are new and were found in North Manchuria. A. G.

New and Remarkable Floating Algæ.—A. C. J. VAN GOOR ("Ueber einige neue und bemerkenswerte Schwebealgen," *Rec. trav. bot. néerland.*, Amsterdam, 1924, **21**, 297–328, 11 figs. in text). Descriptions of seven new species and one variety of microscopic plankton algæ, and critical discussions of three others. *Monoceros* is a new genus, founded on a new diatom, *M. isthmiiforme*. A. G.

Melosirineæ.—A. C. J. VAN GOOR ("Zur Charakteristik einiger Melosirineæ," *Rec. trav. bot. neerland.*, Amsterdam, 1924, **21**, 329–67, 9 figs. in text). A critical discussion of nine species of diatoms belonging to the genera *Lysigonium* (3) *Gallionella* (1), *Melosira* (5). *M. subtilis* is described as a new species. A. G.

Manchurian Desmids.—B. W. SKVORTZOW ("A Contribution to the Desmids of North Manchuria," *J. Bot.*, 1926, **64**, 121–32, 13 figs.). A list of 152 Desmids collected mostly near Harbin, in a country for which few freshwater algæ have been recorded hitherto. Six new species are described and figured, and a bibliography is appended. A. G.

Chinese Myxophyceæ.—N. L. GARDNER ("Notes on a Collection of Freshwater Myxophyceæ from Amoy, China," *Rhodora*, 1926, **28**, 1–4). A list of determinations of a small collection of freshwater forms preserved in formalin and collected near Amoy by Prof. H. H. Chung. Among the twenty-nine indicated there are four new species and two new varieties. Descriptions of these are given. A. G.

Merismopedia.—HALINA RYPPOWA ("*Merismopedia* (subgenus *Pseudoholopedia*) *gigas* nov. subgen. nov. sp.," *Acta Soc. Bot. Poloniæ*, 1925, **3**, 42–88, 1 fig.). A description of *Merismopedia gigas*, the type of a new species and subgenus, found in stagnant water in Roumania; and a discussion of this genus of Cyanophyceæ, for which five subgenera are defined. A. G.

Sandstone Flora in Latvia.—N. MALTA ("Die Kryptogamenflora der Sandsteinfelsen in Lettland," *Acta Horti Bot. Univ. Latviensis*, 1926, **1**, 13–32, 4 figs.). An account of the cryptogams found on the sandstone rocks of Latvia, including 29 Cyanophyceæ, 24 diatoms, 25 other algæ, 35 lichens, 42 hepatics, 86 mosses, and 9 pteridophytes. The ecology of this flora is discussed—the wet rocks, the caverns, the dry rocks, their respective conditions and flora; the distribution of the flora. A. G.

Italian Lake Algæ.—B. FORNI ("Contributo alla Ficologia del Verbano," *Atti Istit. Bot. Univ. Pavia*, 1925, Ser. III, **2**, 361–76). Finding no satisfactory record of the freshwater algæ of Lago Maggiore (Lacus Verbanus), Dr. Don B. Forni publishes a list of 105 species collected in the southern limb of the lake, and hopes to continue the study in subsequent papers. A. G.

Batrachospermum.—KATHLEEN M. GOODWIN ("Some Observations on *Batrachospermum moniliforme*," *New Phytologist*, 1926, **25**, 51–4). The colour of this alga varies widely according to natural conditions. An account is given of experiments made with the plant. It can be cultivated in the laboratory in well-aerated running water. The water employed had a high iron content and slight alkalinity (p H 7·5). The natural olive-green form, if cultivated in diffuse light, gradually changes colour from olive-green to red. Such red colour is quite normal, and the plants healthy. The red colour is due to phycoerythrin, which masks the chlorophyll, and is usual in deep-water or shade-grown specimens. A. G.

Kyliniella.—H. SKUJA ("Eine neue Süsswasserbangiaceæ *Kyliniella latvica*, n.g., n. sp.," *Acta Horti Bot. Univ. Latviensis*, 1926, **1**, 1–6, 1 pl.). *Kyliniella* is a new genus of algæ found growing epiphytically on *Chara*, *Phragmites*, *Scirpus*, etc., in Lake Usma, Latvia. It is a microscopic plant belonging to the Bangiaceæ, and is allied to *Phragmonema* Zopf. A. G.

Rhodymenia.—CHARLES KILLIAN ("Le Développement Morphologique et Anatomique du 'Rhodymenia palmata,'" *Ann. Sci. Nat. Bot.*, Sér. X., 1926, **8**, 189–211, 26 figs. in text). A microscopical study of the development of *R. palmata* sporelings, from the primitive cushion. The apical portion of this cushion grows into a cylindrical shoot with a distinct axis and cortex. After a time the apical cell is replaced by a marginal meristem which produces the flat frond; and the axial strand is replaced by a medullary tissue. The apical meristem of the frond remains active, the basal disappears. In the stalk growth is periodical; hence the formation of zones. The author compares or contrasts this mode of development with what is known to occur in *Lomentaria*, *Gracilaria*, *Phyllophora*, and other Florideæ. A. G.

Marine Red Algæ of Friday Harbour.—Harald Kylin ("The Marine Red Algæ in the Vicinity of the Biological Station at Friday Harbour, Wash.," *Lunds Universitets Årsskrift*, 1925, N.F. Avd. 2, Bd. 21, Nr. 9, pp. 1–87, 47 figs.). An account of the red algæ collected in the vicinity of the Biological Station at Friday Harbour, Washington, U.S.A., during a summer visit in 1922. In all, 128 species are enumerated, and 31 of these are described as new to science, together with three new genera—*Thuretellopsis*, *Opuntiella*, *Pugetia*. A key to the genera is provided, as well as keys to the species in each genus. Some of the species are copiously illustrated with text-figures, and many critical notes are supplied. A. G.

Fungi.

Mycological Contributions.—M. O. Reinhardt ("Mycologische Mitteilungen," *Ber. Deutsch. Bot. Gesells.*, 1925, **43**, 463–8, 1 fig.). The author gives an account of the systematic position and nomenclature of *Mucor botryoides*. The fungus forms long or short aerial hyphæ which branch above and bear sporangia; the lower hyphæ develop as stolons or rhizoids. Reinhardt considers finally, however, that it belongs to the genus *Mucor* rather than to *Rhizopus*. Several times the same species has been described and given different names, but the name *Mucor botryoides* Lendner has been retained. A. L. S.

Overwintering of Phytophthora infestans.—Helena L. G. De Bruyn (*Phytopathology*, 1926, **16**, 121–40). The great problem has been whether the fungus could live in the soil and endure low winter temperatures. The writer of the paper gives a history of the research work done on this problem, and describes her own methods and results. She has found that the fungus can live saprophytically, and that it grows best on old partially decayed plants; it is therefore able to find nourishment in nearly all soils. Moisture is important especially at the time of infection; but the fungus can resist drought as well as cold. The oospores and the resting forms are the resistant organs. If the *Phytophthora* finds suitable conditions in any small area, these will be enough overwintered to inaugurate a blight epidemic in the new season. If the tuber were the source of infection, care in selection of seed potatoes would ensure a healthy crop, but owing to the fact that overwintering in the soil is possible and probable, then good tubers are not sufficient protection, and no way of killing the fungus in the soil has been suggested. A. L. S.

Origin of Coremium Formation.—ADALBERT BLOCHWITZ ("Der Ursprung der Coremienbildung u. das sog. *Coremium silvaticum* Wehmer," *Ber. Deutsch. Bot. Gesells.*, 1925, **43**, 95–105). Blochwitz by means of cultures of these fasciculate forms of *Penicillium* has established that the *Coremium* formation is an inherited condition. The whole question of the relation of *Coremium* to *Penicillium* is discussed at length. A. L. S.

Study of Yeasts.—IRENE LIPSKA ("L'Influence des Races de Levûres sur les Fermentations et sur la Composition Chimique des Vins de Fruits," *Acta Soc. Bot. Pol.*, 1925, **3**, 1–28). The questions requiring to be solved were:—(1) Do yeast races maintain their specific characters on the wort of different fruits? (2) Does the chemical difference in the various fruits affect the yeasts? (3) Is it possible for a chemical analysis of wine to determine the fruit from which it was made? (4) Is it possible to establish the relation with a definite yeast and the composition of the wine? Materials and methods are described and the results finally set out in eighteen tables. As to the questions propounded, the author has found:—(1) There are several races of grape yeasts which give good results on the wort of fruits. (2) A fruit juice even strongly diluted will give a good wine with a pure race of appropriate yeasts. (3) Certain specific characters of a yeast may be constant and not change with the wort used, though (4) some properties may vary under the chemical influence of different worts. (5) It has not been possible to determine any fermentation characters existing between the yeast and the chemical analysis of the wine, but (6) the chemical product of fermentation may vary in the same wines according to the race of yeast used. Finally (7) the specificity of yeasts is shown in the varying capacity of growth and of fermentations. A. L. S.

Study of Yeast Cytology.—G. NADSON and A. KONOKOTINE ("Étude Cytologique sur les Levûres à Copulation Heterogamique du Genre Nadsonia Syd," *Ann. Sci. Nat. Bot*, Sér. X., 1926, **8**, 165–83, 2 text-figs., 2 pls.). The yeast genus *Nadsonia* was first published under the name *Guilliermondia*, and was obtained from the slime-flux of an oak. A new species, *Nadsonia elongata*, was found on birch-flux, and the cytology has been examined by the authors. In this genus copulation takes place between a cell and one of its budded cells. The authors have concentrated on the behaviour of the nucleus. They could never detect any mitosis; the nucleus is composed of three parts, the membrane, nucleoplasm and chromatic granules—a type of nucleus found in many lower organisms, vegetable and animal. The chromatic granules or caryosomes issue from the vesicular membrane, and after a bud has been formed a caryosome passes into it. Full accounts are given of the processes entailed. The authors think that this type of nuclear division represents traces of simplification or degradation as compared with the ascomycetes. The processes of copulation and spore-formation are also fully described. A. L. S.

Culture of Aspergillus niger.—T. SAKAMURA (*J. Coll. Agric. Hokkaido Imp. Univ.*, 1926, **14**, 65–128; see also *Zeitschr. Bot.*, 1926, 18, 191–4). Sakamura has made a research into the substances used in his culture media and their influence on the fungus. Thus with mannite as the source of carbon very few spores germinated. He was not able to observe any formation of oxalic acid in the first cultures. Growth and change were tested with a series of nitrogen salts. With some of these salts there was a formation of oxalic acid. Research was also made as to correspondence between the concentration, etc., of the medium and the growth of the *Aspergillus*. A. L. S.

Origin of Aspergillus Varieties with Branched Conidiophores.—ADALBERT BLOCHWITZ (*Ber. Deutsch. Bot. Gesells.*, 1925, **43**, 105–8). Blochwitz describes a culture of *Aspergillus flavus* along with *Mucor* or *Rhizopus* which it parasitized. The *Aspergillus* formed elongate conidiophores which branched near the apex. A number of questions as to the peculiar development are discussed. A. L. S.

Monographic Study of the Genus Cucurbitaria in North America.—DONALD STUART WELCH (*Mycologia*, 1926, **18**, 51–86, 2 pls., 5 figs.). The author has made a study of all the species placed in the genus *Cucurbitaria*. The type species was based on *Sphæria Berberidis* Pers., a well-defined species of wide distribution in Europe and also in America. Many species have been included in the genus by various mycologists. Welch finds that only five are true *Cucurbitariæ*. He gives the history of all the doubtful forms, and where possible indicates the groups to which they truly belong. A. L. S.

New Discomycete from Brandenburg.—W. KIRSCHSTEIN ("Ein neuer markischer Discomycet," *Verh. Bot. Ver. Prov. Brandenburg*, 1923, **65**, 122–4). The new fungus, found six years previously, proved to be a new genus and species named by the author *Claussenomyces Jahnianus*. It belongs to the Bulgariaceæ and grew on a fallen oak branch. The spores are acicular, 7-septate and hyaline or slightly olivaceous-green. A. L. S.

Three Fungi Imperfecti.—JESSIE S. BAYLISS ELLIOTT (*J. Bot.*, 1926, **64**, 105–8, 3 figs.). The first, *Dispira circinata*, new to science, was found on a sheep-dung culture in the Zoological Laboratory, Birmingham; it is near to *D. cornuta*, but differs in having five or six instead of two branches radiating from the head of the conidiophore. *Scopularia venusta* formed broadly-extended patches on cones of *Pinus sylvestris*, the heads of hyaline conidia standing out as minute white spots. It is a Hyphomycete belonging to the Dematiaceæ. *Tolypomyria microsperma* forms masses of spores on the elongate fertile portions of the conidiophore. The two latter were found at Tamworth-in-Arden and are new to the British Flora. A. L. S.

Problem of Terminology in the Rusts.—J. C. ARTHUR and F. D. KERN (*Mycologia*, 1926, **18**, 90–3). The writers desire to have a terminology accepted for the different stages of rust fructification that will correlate these stages and be intelligible. They rank all the fruiting structures—even the pycnidia—as sori. The vegetative body is the mycelium parastic in the tissues of the host. The whole of the rusts may be divided into long-cycle and short-cycle, and suggest macrocyclic and microcyclic for these two groups. The main differences in terminology are the shortening of the old terms, thus æcidium becomes æcium and teleutosorus telium, etc. A. L. S.

Physiologic Specialization in the Leaf-rust of Wheat, Puccinia triticina Erikss.—E. B. MAINS and H. S. JACKSON (*Phytopathology*, 1926, **16**, 89–120, 4 pls.). The object the authors had in view in their experiments was to determine the susceptibility of wheat varieties to leaf-rust, and to obtain, if possible, resistant varieties, as also to ascertain the value of their resistance. *Puccinia triticina*, they found, consists of at least twelve physiologic forms; twenty-five strains of wheat have been found to be more or less resistant to one or more of these forms. No form of rust has been found, so far, to which all of these varieties are susceptible. On the other hand, no variety has been found which in the seedling stage is highly resistant to all twelve of these forms. The physiologic forms of the rust are not generally found pure in the field, but practically always several are found mixed together, nor are they fixed or limited in their distribution. Agronomic varieties of wheat are not necessarily uniform in their reaction to leaf-rust. Full account is given of the many experiments with cultures and with inoculations, and some pages are given to a discussion of the nomenclature.

A. L. S.

Nuclear Phenomena and Life-history of Urocystis Cepulæ.—ALPHEUS W. BLIZZARD (*Bull. Torrey Bot. Club*, 1926, **53**, 77–117, 1 fig., 4 pls.). The paper is an answer by experimental research to a number of questions regarding the development of onion-smut. Seedlings are infected in the soil: mature pustules of the fungus appear within three to four weeks, and the spores germinate more or less readily by the protrusion of a promycelium which produces by growth and branching a weft of mycelium. The fungus was also isolated and grown for cytological examination. During germination the spore nucleus divides within the spore; the nuclei migrate to the promycelial branches, which segment to uninucleate cells; conjugation between the branches does not occur. Each mycelial cell of the saprophytic mycelium may function as an oidial spore which is uninucleate and produces a uninucleate mycelium. Desiccation does not kill the fungus in the soil. The parasitic mycelium is intercellular; the cells become binucleate as they approach the sorus primordium. The spore-ball originates from a group of sporogenous branches. The fertile spore originates from a binucleate, centrally located cell of a sporogenous branch. The two spore nuclei soon fuse: the spore-cell then increases in size. Pseudo-spores originate also from binucleate cells of the sporogenous branches, and serve as nurse-cells to the central fertile spore against which they are appressed. A. L. S.

Notes on the Ustilagineæ of Washington.—GEORGE L. ZUNDEL (*Mycologia*, 1926, **18**, 87–9). The species recorded supplement a list published by the author in 1919. The species are of world-wide distribution, and are now reported from various localities. They are:—*Tilletia Guyotiana*, *T. Rauwenhoffii*, *Ustilago bromivora*, and *Sphacelotheca Hydropiperis*—the last on a shrub of *Polygonum*. A. L. S.

Cortinarius Cyanites in the United States.—LOUIS C. KRIEGER (*Rhodora*, 1925, **27**, 153–6). The above species was discovered among dead leaves in New Hampshire in 1906; it is one of the rarest as well as one of the most beautiful of *Cortinarii.* A full description of the species, and a bibliography referring to the fungus since Fries first published it in 1838, are appended. A. L. S.

American Agarics.—C. H. KAUFFMAN ("The Genera *Flammula* and *Paxillus* and the Status of the American Species," *Amer. J. Bot.*, 1926, **13**, 11–32). The writer has given a history of these two generas, synoptic keys and additional notes on most of the species. In *Flammula* he includes fifty-two species, in *Paxillus* twelve. A bibliography is added. A. L. S.

Sexual Mutations of Basidiomycetes.—RENÉ VANDENDRIES ("Les Mutations Sexuelles des Basidiomycètes," *Bull. Soc. Roy. Bot. Belgique*, 1925, **58**, 28–37). The work was done on the species *Coprinus radians*, which was determined as such with great care. Vandendries gives the formula, "If the haplonts of two carpophores are always and indefinitely fertile when united, these two carpophores belong to one species." Monosperm cultures were instituted, and it was found that certain haplonts continued to grow in a test-tube for five months without losing vitality. In certain cultures mutation to the diploid condition appeared and clamp connections were observed; but it has not yet been possible to obtain carpophores from these cultures. A. L. S.

Thelephoraceæ of N. America: XIV.—EDWARD ANGUS BURT (*Ann. Miss. Bot. Gard.*, 1925, **12**, 213–357). Burt has gathered into *Peniophora* a large number of fungi described under other genera. He also describes a considerable number of new species. Full references are given and ample descriptions. A. L. S.

Mycorrhiza of the Yew.—H. PRAT ("Étude des Mycorhizes du *Taxus baccata*," *Ann. Sci. Nat. Bot.*, Sér. X, 1926, **8**, 141–63, 15 text-figs). The author has made a complete study of the endotrophic mycorrhiza of the yew, beginning with the stage of penetration by the hyphæ. In other conifers there is an ectotrophic mycorrhiza, but that type is absent from the yew. The fungus enters by the absorbing hairs, and fills certain cells of the cortex with vesicles and branching coils termed arbuscules: the invaded roots show a warted surface; they are generally deformed and irregularly swollen. The fungus never penetrates beyond the endodermis; it does not enter the bark of the rootlets, which have an endogenous origin. Finally, the fungus is thrown off with the formation of the corky layer. In the spring there is a new infestation of the new roots by external hyphæ. In any case the association is constant and can only be regarded as symbiotic. The influence of the fungus on the yew requires, however, to be more thoroughly investigated. A. L. S.

Tree Mycorrhiza.—ELIAS MELIN ("Untersuchungen über die Bedeutung der Baummykorrhiza. Eine mycologische-physiologische Studie," Gustav Fischer, Jena, 1925, pp. i–vi, 1–152, 48 text-figs.). The present paper describes the author's experiments on the investigation of

nutrition both on the fungus and on the tree in order to understand their relation to each other. Melin dealt with the mycorrhiza of conifers. He found that the isolated fungus was markedly stimulated when brought into contact with the seedlings of conifers, and he concluded that to excreted phosphates was due the effects produced. There was no evidence of nitrogen fixation by the fungus; but Melin holds that mycorrhiza possesses a vital significance for trees growing in humus.
A. L. S

Apparent Symbiosis between a Fungus and Marchantia.—H. CHANDKURI and RAJARANO ("Ein Fall von wahrscheinlicher Symbiose eines Pilzes mit *Marchantia nepalensis*," *Flora*, 1925, 4 ser., **20**, 176–8, 2 figs.). The fungus was found in the gametophyte of the Hepatic, and confined to a zone under the air-chambers. The hyphæ were branched and coiled up within the cells; chlamydospores were occasionally found. In very young plants the fungus was also found in the lowest cells of the *Marchantia* and even in the rhizoids. Cultures were made, and these proved that the *Marchantia* could not develop normally without the fungus. In a culture of the fungus itself it was proved that it was dependent on the host for its carbohydrate. What it gives to the host was not discovered, but it was considered to be evidently a true instance of symbiosis. A. L. S.

Fungi of San Domingo.—RAFAEL CIFERRI and ROMUALDO GONZALEZ FRAGOSO ("Hongos parasitos y saprófitos de la Republica Dominicana," *Estacion Agronomica de Haina*, *Serie B. Botanica*, *San Domingo*, n. 1, 1925, 1–15). Fragoso in this contribution publishes only microscopic species parasitic or saprophytic, with one exception, *Polystictus sanguineus*. There are included Uredineæ, Pyrenomycetes, Discomycetes and Fungi Imperfecti. In the last group he describes a new genus and species of Sphæropsideæ, *Ciferria coccothrinacis*. A. L. S.

Parasitic Fungi collected in the Neighbourhood of Niepruszwo near to Buk.—TADENSZ DZIEGIELOWSKI ("Grzyby okolic Nieруszewa powiatu grodziskiego ze szczgólneno uwzglednienieni pasorzytów drzew i krzewów lesnych," *Kosmos*, *Bull. Soc. Pol. Naturalistes a Leopol*, 1925, 895–916). The fungi enumerated to the number of 141 species are nearly all parasitic on trees or on herbaceous plants. This is the first work devoted to the region in the N.W. of Poznań. The host as well as the parasite is recorded. Some are included that are not parasitic, such as *Cantharellus cibarius*. A. L. S.

Studies in Biochemistry.—SOPHIA SATINA and A. F. BLAKESLEE ("Studies on Biochemical Differences between (+) and (−) Sexes in Mucors," *Proc. Nat. Acad. Sci.*, 1925, **11**, 528–34). The writers have considered that whereas in Mucors there is a strong sexual distinction in the hyphæ that distinction might be reflected in biochemical behaviour. Chemical differences had already been found and formulated by other workers to some extent. The tests applied in the present investigation was the power of reaction reduction—the capacity to absorb salts of Te. and Se. and reduce them to these elements, black in the case of Te., red in Se. The experiments and methods and the results obtained are explained and set out in tabular form. They conclude that the power of reduction has no direct relation to the sexual strength of the races, nor to vegetative vigour, nor is it related directly to differences in the size of the spores; but they affirm the variability of races of the same sex with regard to their ability to reduce the above compounds. On the average the (+) sex has a greater power of reduction than the (−), though they consider that the difference may be due to non-sexual factors. A. L. S.

Exoascus Disease of the Almond.—WILLIAM G. CAMPBELL (*Trans. Proc. Bot. Soc. Edinb.*, 1925, **29**, 186–91, 4 figs.). The disease had been noticed in the St. Andrews Botanic Garden for several years; nearly all the foliage, leaves and twigs of the attacked tree were infected in 1923. The first indication of infection of the leaves is in May when the leaf buds open. Campbell has made a thorough study of the tissues and finds that the fungus hibernates in the walls of the phloem elements of the shoots, and therefore in close proximity to food supplies. In June or July the asci are formed on the leaf. The colouring matter is discussed, as also the systematic position of the fungus, but the conclusion come to was that it is a variety of *Exoascus deformans*.
A. L. S.

Raspberry Canker.—N. L. ALCOCK (*Tom. cit.*, 197–8). The causal fungus has been identified with *Nectria Rubi*. The disease was recorded in Dublin in 1916. It has now appeared at Beaufort Castle, Scotland, and elsewhere. The alternate fungus stage, *Fusarium*, was also found on the roots of the raspberry canes. A. L. S.

Lichens.

Chili Lichens collected by C. Skottsberg.—A. ZAHLBRUCKNER ("Chilenische Flechten gesammelt von C. Skottsberg," *Goteborgs Bot. Trädgård*, 1925–6, **2**, 1–16). The considerable number of lichens now listed and described were collected by Skottsberg during his expedition to Juan Fernandez, and they are from two provinces, Coquimbo and Santiago, in both of which the rocks are of volcanic origin. Most of the species are saxicolous, but a few are corticolous, such as *Arthopyreniæ* and *Arthoniæ*. He notes concerning *Roccellina* that that genus is properly a section of *Dirina* with a more squamulose thallus, and Darbishire's species of *Roccellina* becomes *Dirina condensata* A. Zahlb. nov. A number of new species are described. A. L. S.

Lichens of Siliceous Rocks in the Central Parts of the Labe Plain.—ALFRED HILITZER ("Lišejníky Kremitych skal v Středním Polabí. Les Lichens des rochers siliceux dans la partie centrale de la plaine de Labe," *Zolastní otisk z Preslie*, 1923–5, **3**, 10–22; Czecho-Slovakian with French Résumé). The Labe plain lies in Central Bohemia to the north of Prague, and scattered over it are isolated dry hot rocks, either lydite or schist, rising to a height of 269 m. On the S. and S.E. smooth sides of the lydite there is an association, termed *Rinodina oreina*, an extremely xerophilous group. At the top of the rocks, where birds rest, there is a nitrophilous Association, *Ramalina strepsilis* and others, and to the N. and N.E. an *Aspicilia cæsiocinerea* Association. In general the lichen vegetation is xerophilous with always an intermixture of nitrophilous species. He notes that the three species *Placodium rubinum*, *Rinodina oreina* and *Acarospora oxytona* are common lichens above the high forests, but rare and isolated in the lower lands of Central Europe. Their presence in the Labe plain is explained by their extreme xerophilous character; they choose in the plain the heated rocks, in the mountains the highest and driest places. Hilitzer concludes that the degree of humidity in the air plays an all-important rôle in the ecology of lichens. A. L. S.

Study of Epiphytic Vegetation in Bohemia.—ALFRED HILITZER (*Publ. Fac. Sci. Univ. Charles, Prague*, 1925, 202 pp.; French). Hilitzer, at the outset, states that he has limited his study to "vegetation" in natural conditions. Isolated trees and alleys present different conditions. The vegetation is composed of Cryptogams, and is mostly on trunks or branches of trees. In Bohemia few Cryptogams grow on leaves. His table of contents gives a comprehensive view of the whole subject in which lichens play a large part. His methods of arrangement are given; his study of place and position of atmosphere and locality. He also regards the plants ecologically as "eurychoric"—i.e. capable of living in widely diverse conditions—or "stenochoric," limited to certain places or conditions. Other divisions into groups are given, such as climatoid and substratoid, etc. He adopts Du Rietz's method of counting the plants on uniform small areas and naming the Association from the dominant plant. In the 33 Associations which he has described, the dominant plant or plants in 23 are lichens; in 8, mosses or hepatics, and in two algæ—Protococcaceæ in one, and Trentepohliaceæ in another. A. L. S.

Cladonia apocarpa: a New Species.—C. A. ROBBINS (*Rhodora*, 1925, **27**, 210–11). The writer has described a *Cladonia* on squamules alone, but considers these are so distinctive that there is no doubt that they differ from those of other *Cladoniæ*. These squamules are somewhat similar to those of *C. foliacea*, but thinner, and of a grey colour. A. L. S.

Lichens of Easter Island.—A. ZAHLBRUCKNER (*Natural History of Juan Fernandez and Easter Island*, edited by Carl Skottsberg, 1926, **2**, 450–60). The author writes that very little had been known hitherto about the lichens of Easter Island. Skottsberg collected 22 species, mostly from the volcanic rocks, and on these rocks as previously observed *Buellia* was the genus best represented; 3 of that species described are new to science. In an appendix several species hitherto unrecorded are described for Juan Fernandez, and 3 of those are new species of *Buellia*. A. L. S.

Critical Enumeration of Bohemian Parmeliaceæ.—ALFRED HILITZER (*Ann. Mycol.*, 1924, **22**, 219–29). An account of Parmeliaceæ collected by the author, with critical notes on the species. His genera are: *Candelaria*, *Parmeliopsis*, *Parmelia* (including *Evernia* *furfuracea*) and *Cetraria*. Hilitzer, following the method of Nylander and Hue, has arranged the species of *Parmelia* in "Stirps." A. L. S.

Physiology of Colour Difference in Xanthoria.—FR. TOBLER ("Zur Physiologie der Farbunterscheide bei *Xanthoria*," *Ber. Deutsch. Bot. Gesells.*, 1925, **43**, 301–5). Tobler recognizes that the colour changes of *Xanthoria parietina* are due to the presence or absence of parietin. He has made an anatomical study of the thallus to determine the origin of the changes, and therefore of the varieties and forms—*chlorina*, *albicans*, *virescens*, etc. He finds (1) that the deeply coloured thalli show great deposition of parietin, the gonidia being unaffected; (2) thalli in sunlight as compared with those in the shade show stronger deposit of parietin, thicker cortex and more numerous densely packed gonidia with more starch formation; (3) green thalli, as, for instance, var. *virescens*, show a denser gonidial zone and less parietin. Parasites do not affect the amount of parietin, but as they destroy the gonidia they may, if in great abundance, have some effect on the colour of the thallus as a whole. Tobler concludes that the production of parietin is associated with the interchange of substances between the symbionts, and goes along with the formation of starch, and that increase of colour may thus be conditioned by the abundance of the gonidia with a resultant high degree of assimilation. Lack of moisture retards the development of gonidia and contributes to the lowered formation of parietin. Thus the colour forms are merely growth conditions depending largely on the condition of the gonidial zone. Sunlight has directly less bearing on the colour of the thalli than the state of the gonidia. A. L. S.

Schizophyta.

Schizomycetes.

Morphology of B. melitensis and B. abortus.—G. FAVILLI ("Recerche Comparative Sulla Morfologia del *B. melitensis* e del *B. abortus* (Bang)," *Lo Sperimentale*, **79**, 1925, 1041–8) attempted to distinguish morphologically between *B. melitensis* (7 strains) and *B. abortus* (20 strains), but found both organisms were pleomorphic, presenting coccoid, cocco-bacillary, and definite bacillary forms. Amato's brilliant cresyl-blue stain applied to each bacillus in 24 or 48 hour and even 8–10 day broth cultures demonstrated a very minute round granule, stained dark blue, and situated either at the equator or near one end of each of the two species of organism. When stained for flagella a short prolongation of the protoplasm was noted at one end of the organism, considerably thicker than a flagellum, and no longer than the bacillus; straight or recurved. Examination under dark-ground illumination failed to show any true movement of either organism; the active Brownian motion was not hindered by the presence of weak solutions of antiseptics. Further, the use of Rovidà's sand tube also failed to demonstrate any movement. This protoplasmic prolongation can, therefore, hardly be regarded as a true flagellum. Morphologically, Favilli considers the organisms indistinguishable. J. E.

MICROSCOPY.

B. Technique.

(2) Preparation of Objects.

Alcohol Fixation.—B. KARDASEWITSCH ("Äthylalkolol als fixierende Flüssigkeit in der mikroskopischen Technik," *Zs. wiss. Mikrosk. Leipzig*, 1925, **42**, 1–15, 1 pl.). This is mainly a review ending with a useful list of references. Experiments made on the egg-cells of Ascaris show that the best concentration of alcohol for fixing purposes is 70 to 80 p.c. C. D. F.

Fixation of Mitochondria.—A. CHURA ("Beitrag zur Fixation der Mitochondrien," *Zs. wiss. Mikrosk. Leipzig*, 1925, **42**, 55–60). The following method is recommended for the demonstration of mitochondria and nuclei in cells of various organs of mammals. Fix for 24 hours in a mixture of 1·5 p.c. chromium fluoride, 1·5 p.c. chromalum and 7·5 p.c. potassium bichromate $\overline{aa}$ 25 c.cm. to which add 5 c.cm. of a saturated solution of picric acid and 20 c.cm. of formalin. Transfer for 3 days into a mixture of equal parts of 1·5 p.c. chromium fluoride, 1·5 p.c. chromalum and 7·5 p.c. potassium bichromate changing the fluid every day. Wash for 24 hours at first in water containing some lithium carbonate and then in running tap-water. Embed in paraffin. Sections of 2 to 4 μ can be stained with iron hæmatoxylin or Benda's crystal violet or Altmann's anilin fuchsin or Cowdry's modification of this method. C. D. F.

Formalin Fixation of Peripheral Nerves.—E. FOLKESON and E. BERGSTAD ("Beitrag zur Kenntniss der Einwirnkung von Konzentration und osmotischem Druck auf periphere Nerven bei Formalinfixierung," *Zs. mikrosc. anat. Forsch.*, 1925, **2**, 582–97, 2 text-figs. and 1 pl.). In peripheral nerves of rabbits fixed in 10–40 p.c. formalin the thickness of the myelin and that of the axiscylinder of the individual fibres are in the same proportion to one another as in the fresh (unfixed) fibres; in addition the neurokeratin has a finely reticular appearance and the oblique clefts have the same size as in fresh specimens. In nerve fixed in 1–2 p.c. formalin, the axiscylinders are shrunk, the medullary sheaths swollen and the oblique clefts larger than in fresh fibres. This change is reversible and disappears by transferring the fibres to more concentrated solutions of formalin. This seems to indicate that the clefts are delimited by a semi-permeable membrane. C. D. F.

(4) Staining and Injecting.

Rapid Staining of Spirochætes.—M. J. SABRAZÈS ("Coloration simple et rapide du Tréponéme de la Syphilis dans les frottis," *C.-R. Acad. sci.*, **182**, 1926 (874–5)). The method is summarized as follows:

—Prepare a very thin film of the serum collected *sec. artem* upon coverslip: dry in the air and fix by passing rapidly three times through a bunsen flame, film side uppermost: cover the film with Ziehl's undiluted carbolic fuchsin : heat above a bunsen flame until just steaming : remove until steaming ceases. Be careful to avoid boiling of the stain. Repeat the process at least three times. Now plunge the coverslip into water and remove the excess of colouring matter with the least possible movement. Dry in the air and mount the coverslip in cedar-wood oil. Sabrazès states that Treponema pallidum stains a faint red—without distortion. J. E.

The Stain Affinities of Various Spirochætes.—M. J. SABRAZÈS ("Chromophilie comparée des spirochætes," *C.-R. Acad. Sci.*, **182**, 1926, 875–6). For the purpose of diagnosis Sabrazès employs the following method:—A homogeneous light emulsion is employed for the preparation of smears which are dried by shaking in the air, and upon the film is allowed to fall coverslips charged with small central drops of various stains, using on the same smear coverslips charged with aqueous solution of methylene blue (1/500), carbolic toluidine blue (1/100) and carbolic fuchsin (1/3). The author finds that the Trep. Schaudin is chromophobic with regard to the methylene blue and the toluidine blue, but is coloured by the warm Ziehl fuchsin. Spr. icterohemorrhagica is very feebly coloured by the blue, but it takes the fuchsin slightly in the cold. Spr. gallinarum stains well with the blue and the Ziehl fuchsin, as do also Spr. duttoni and the different species of spirochæte of recurrent fever. The spirochæte of hæmorrhagic bronchitis (Castellani) is very chromophilic for the blues and for Ziehl fuchsin. The spirochætes and fusiform bacilli of Vincent behave in the same fashion. The various spirochætes of the mouth and preputial smegma exhibit the same tinctorial reactions as the spirochætes described by the author as present in the intestines of typhoid cases, and in the peritonitis which follows perforation. J. E.

Blood Staining in Sections—H. A. KULL ("A Method of Blood Staining which Replaces Injections," *Anat. Rec.*, 1925, **31**, 281–4, 1 text-fig.). Thick celloidin sections are stained in Kull's copper carmine, rinsed in distilled water and differentiated in acid alcohol. After washing in distilled water they are stained with indigocarmine, the excess stain being washed off with distilled water. Differentiation can be carried out with picric acid or van Gieson's picrofuchsin. Sections are finally cleared in origanum oil and mounted in Canada balsam. R. J. L.

Impregnation of Epithelial Fibrils.—P. DEL RÍO-HORTEGA ("Manera sencilla de teñir epiteliofibrillas y ciertos reticulo protoplásmicos de difícil demostración," *Bol. r. soc. españ. hist. nat.*, 1926, **26**, 107–13). The following method is recommended for the impregnation of epithelial fibril and intracellular networks of difficult demonstration :—Thin frozen sections from formalin material are collected in distilled water and without washing passed into the silver carbonate solution proposed by the author for the staining of microglia. After adding one drop of pyridine for every c.cm. of solution, this is warmed over a spirit lamp up to 50°–55° C. As it gets warm the silver carbonate solution becomes turbid without, however, precipitating on the sections which are washed in distilled water as soon as they have assumed a reddish-brown colour. No reduction or toning are necessary but only fixation in 5 p.c. sodium hyposulphite. Wash once more, dehydrate, clear and mount in the usual way. C. D. F.

(6) Miscellaneous.

Diffraction in Biological Structures.—ADRIANUS PIJPER (*S. Afr. Med. Rec.*, June, 1925; *loc. cit.*, June, 1923 (Reprints)).

I.—This author, from his examination of surface cultures of members of the coli-typhoid group, asserts in his first communication that colonies of the coli-typhoid group form natural diffraction gratings. The slits of such gratings are circular and therefore produce circular spectra, and from the size of these spectra the distance between the slits of the gratings can be calculated, by the help of the formula $d = \frac{l\sqrt{f^2 + r^2}}{r}$ (where d is the distance between the slits, f is the focal distance of the lens used, r is the radius of a colour circle of the spectrum produced, and l is the wave length of that colour), from which it was found that the distance between the slits was equal to the transverse diameter of the bacilli under observation. It therefore follows that the transverse diameter of a bacillus can be calculated from its diffraction spectrum. All the bacilli in such a culture stand upright, at right angles to the surface of the medium upon which they are multiplying. The diffraction effect becomes visible when the culture holds 300 million bacilli to the square centimetre, is well marked at 600 millions, but loses its brilliancy at 2,000 million.

II.—In his second article Pijper endeavours to elucidate the phenomena responsible for this vertical arrangement. The nutrient solid substratum—agar—employed in his observations exists as agar gel, and as such exhibits syneresis, which causes the expression of a thin film of fluid over the surface of the gel: the bacteria are therefore growing in a fluid medium, spread over the agar surface in a layer several microns in depth. Physical factors cause bacterial growth to take place in the outer layer of this thin fluid film, since the electro-negative charge of the bacilli causes their repulsion from the interface between the gel, also negatively charged, and the watery film. Multiplication occurs in the neighbourhood of the interface between the surface of the fluid and the air, at first horizontally, but later, in order to accommodate the largest number in a given area, the bacilli assume the vertical position and are then arranged after fission in parallel rows down to the agar surface.

III.—The author, from further work on this subject, concludes that the diffraction method of measuring the diameter of bacilli shows that the average diameter of the individuals in a given strain constitutes a biological characteristic and is not subject to variation, and that members of the coli-typhoid group show important differences in diameter. He explains Friedberger's experiments on the separation of bacteria by means of their different capillary ascent in filter paper on the basis of differences in their diameters.

IV.—Extending his observations to blood cells the author finds that suspensions of these structures can be used as diffraction gratings. So also can blood smears. These gratings produce spectrums from the size of which the size of the constituent red cells can be calculated. The results obtained are particularly accurate and the average diameter of many millions of erythrocytes in a blood smear can be estimated by a single measurement and a single calculation. He confirms Price-Jones's findings of a diurnal change in the diameter of red blood cells by his diffraction method, and notes particularly that in Addison's (pernicious) anæmia blood smears used as diffraction gratings produce smaller and paler spectrums than do smears of normal blood, and suggests that by the diffraction method of measuring red blood cells Addison's anæmia can be diagnosed at a glance. Reference should be made to the original papers for the technique of the diffraction method, including the making of permanent records by means of colour photography.

J. E.

MICROSCOPICAL PHYSICS.

Smokes.—R. Whytlaw-Gray (*Nature*, 1926, **117**, 201). A discussion of hydrosols, aerosols and aerogels. A number of oxide smokes are considered, from which it appears that even when dilute they are continuously undergoing spontaneous aggregation. The charged particles are never all of one sign.

F. I. G. R.

Soaps and the Theory of Colloids.—J. W. McBain (*Proc. Royal Inst.*, 1925, **24**, 579). In addition to an interesting account of present knowledge in this field, the author gives a remarkable series of illustrations of suspended droplets, potassium and sodium laurate crystallites, and the ultra-microscopic appearance of suddenly-precipitated barium sulphate.

F. I. G. R.

LEATHER INDUSTRY.

Ink Disease of the Chestnut Tree.—J. DUFRENOY (*Le Cuir Technique*, 1925, 490, 510). A biological study of the ink disease illustrated by 28 figures. This disease is caused by the *Blepharospora Cambivora* Petri. Infected trees should be removed and the soil, etc., treated with a 5 p.c. solution of copper sulphate, or dusted with powdered copper sulphate. Surrounding trees are treated with a Bordeaux mixture containing the equivalent to 5 p.c. copper sulphate. The soil round the neighbouring trees is also treated with copper sulphate. A. H.

Properties of Shoe Leather: I. Microstructure.—J. A. WILSON and G. DAUB (*S. Amer. Leather Chem. Assoc.*, 1926, **21**, 193). Specimens of leather for microscopical examination were prepared in the following manner :—Samples were cut from the centre of the butt 1 cm. by 4 cm., and all except those of sole leather suspended in cedarwood oil. They were next rinsed in xylol and then suspended in molten paraffin wax, changing the wax every 5 hrs. The final block of wax containing the samples was next cut up, and sections cut in the microtome. Sections were slightly warmed and dipped into collodion solution, viz. 150 cc. absolute alcohol, 5 cc. ether, 2 gms. parlodion, 2 gms. Canada balsam, and 1·25 gms. castor oil. After dipping for one second and gently waving, the section was placed on a drop of santalwood oil on a slide, covered with the same oil and left for several hours. Flooding with xylol followed, when the section was mounted in Canada balsam. For sole leather, the above procedure was found unsatisfactory. The sample strips were soaked in three changes of ether and left in a 6 p.c. solution of parlodion for a week, soaked in chloroform and left for 2 days in 3 parts xylol and 1 part castor oil Embedding in paraffin wax is next done, giving five changes of wax. Sections were cut, painting the exposed surface with parlodion before cutting. This enabled the section to be held together. Subsequent treatment and mounting was completed as described for other leathers as above. The paper concludes with 18 photomicrographs of various leathers. A. H.

NOTICES OF NEW BOOKS.

A Synopsis of the Families and Genera of Nematodes. H. A. Baylis and R. Daubney. London : Printed by the Trustees of the British Museum. Pp. i-xxxvi, 1–277. Price 10/6.

This book will be of considerable use to the helminthological specialist in that it provides him in small compass with brief, concise generic diagnoses of all the genera of nematodes, animal and plant parasitic as well as free-living forms of which recognizable descriptions have been published up to the end of 1923. In the Introduction the authors explain the method of classification they have adopted and give definitions of a number of terms in common use among helminthologists. This is followed by a systematic index in which the nematodes are classified under orders, families, sub-families and genera. The substance of the work consists of the generic diagnoses which are arranged according to the systematic index. For each genus there is given in addition to the diagnosis, the habitat and the specific name of the genotype with its author and also a brief list of references to the most important papers on it. There are no lists of species and no illustrations, so that specialists and non-specialists will still find it necessary to consult the Index Catalogue of Nematodes by Stiles and Hassall and original papers. The general arrangement of the subject-matter is excellent and the authors are to be congratulated on an admirable piece of work. T. G.

Illinois Biological Monographs :

The External Morphology and Postembryology of Noctoid Larvæ. By Lewis Bradford Ripley. 1923. 102 pp., 8 plates. Published by the University of Illinois. Price $1.25.

The Calciferous Glands of Lumbricidæ and Diplocardia. By Frank Smith. 1924. 76 pp., 12 plates. Published by the University of Illinois. Price $1.25.

A Biologic and Taxomic Study of the Microsporidia. By Roksabro Kudo. 1924. 268 pp., 27 plates and 9 text-figures. Published by the University of Illinois. Price $3.00.

Animal Ecology of an Illinois Elm-Maple Forest. By Asa Orrin Weese. 1924. 93 pp, 7 plates and 15 tables. Published by the University of Illinois. Price $1.25.

Studies of the Avian Species of the Cestode Family Hymenolepididæ. By Roy Lewis Mayhew. 1925. 9 pls., 2 text-figs. Published by the University of Illinois. Price $1.50.

Histogense et Régénération du Muscle chez les Anoures. By André Naville. 1922. 140 pp., 2 plates and 21 text-figures. Published by Imprimerie H. Vaillant-Carmanne, 4 Place Saint-Michel, Liége.

Wilhelm Hofmeister. The Work and Life of a Nineteenth Century Botanist. By Dr. K. Von Goebel, with Biographical Supplement by Frau Professor Ganzenmüller. 1926. Pp. xi + 202, 3 figs., portrait and 2 facsimile letters. Published by the Ray Society.

Fishery Investigations. (Series 2, vol. ix., No. 1.) 1926. The Plankton of a Herring Ground. By R. E. Savage, A.R.C.Sc., D.I.C. Pp. 35, 2 pls. Published by H.M. Stationery Office, Kingsway, W.C.2. Price 5*s*. net.

The Decimal Bibliographical Classification of the Institut International de Bibliographie. (Optics, Light and Cognate Subjects.) By A. F. C. Pollard, A.R.C.S., A.M.I.E.E., F.Inst.P. 1926. Pp. vi + 109. Published by the Optical Society, Imperial College of Science and Technology, South Kensington, S.W.7.

Subject-Index of the Transactions of the Optical Society. Vols. i.–xxv. (1899–1924). By A. F. C. Pollard, A.R.C.S., A.M.I.E.E., F.Inst.P. 1926. Pp. iv + 89. Published by the Optical Society, Imperial College of Science and Technology, South Kensington, S.W.7.

Catalogue of Optical and Scientific Instruments and Dictionary. Part 1: Catalogue of Optical and Scientific Instruments. Pp. viii + 127. With index and illustrations. Part 2: Dictionary of British Scientific Instruments. Pp. 283, 313 figs. 1926. Published by W. Watson & Sons, Ltd., 313 High Holborn, W.C.1.

Index-Catalogue of the Library of the Surgeon-General's Office, United States Army. Authors and Subjects. Third Series. Vol. v.: Eade–Gazzetti. 1925. Pp. 1091. Published by the Government Printing Office, Washington.

Enzyklopaedie der Mikroskopischen Technik. Third edition. A–Feu. Edited by Prof. Dr. Rudolf Krause. 1926. 68 figs. and 11 pls. Published by Messrs. Urban & Schwarzenberg, Berlin, N 24. Price 39 Marks.

The Nervous Mechanism of Plants. By Sir Jagadis Chunder Bose, M.A., D.Sc., LL.D., F.R.S., C.S.I., C.I.E. 1926. Pp. xix + 224. 82 illustrations. Published by Messrs. Longmans, Green & Co., Ltd., 39 Paternoster Row, London, E.C.4. Price 16*s*. net.

PROCEEDINGS OF THE SOCIETY.

◆

AN ORDINARY MEETING

OF THE SOCIETY WAS HELD AT 20 HANOVER SQUARE, W.1, ON WEDNESDAY, MARCH 17TH, 1926, DR. JAMES A. MURRAY, PRESIDENT, IN THE CHAIR.

The Minutes of the preceding Meeting were read and confirmed.

The nomination paper was read of one Candidate for Fellowship.

New Fellow.—Mr. A. Harold Paine was elected an Ordinary Fellow of the Society.

The death was announced of :—

Mr. Edward B. Stringer. (Elected 1912.)

A vote of sympathy with his relatives was passed.

A **Donation** was reported from :—

Messrs. Baillière, Tindall and Cox—
Practical Microscopy. (Scales.)

A vote of thanks was accorded to the donors.

The **President** exhibited and described a Thorium Disc and Gas Illuminant, and was thanked for the same.

The following papers were read and discussed :—

Dr. Mohammed Ali, D.M. & S. (Cairo).
"Studies on the *Bacillus ægypticus*." (Communicated by Professor John Eyre, M.D., F.R.M.S., with Lantern Demonstrations.)

Mr. George H. Needham, M.Sc.—
"A New Method for Washing Diatoms."

Votes of thanks were accorded to the authors of the above papers and to Professor Eyre.

The business proceedings then terminated.

AN ORDINARY MEETING

OF THE SOCIETY WAS HELD AT 20 HANOVER SQUARE, W.1, ON WEDNESDAY, APRIL 21ST, 1926, DR. JAMES A. MURRAY, PRESIDENT, IN THE CHAIR.

The Minutes of the preceding Meeting were read and confirmed.

The nomination papers were read of ten Candidates for Fellowship.

New Fellow.—The Rev. J. G. Dufty was elected an Ordinary Fellow of the Society.

The deaths were announced of :—

Senor D. de Orueta y Duarte. (Elected 1897.)
Mr. A. Seymour-Jones (Elected 1918.)

A vote of sympathy with the relatives was passed.

Donations were reported from :—

Mr. A. Holmes Ellis—
    A Collection of Slides.
Urban & Schwarzenberg—
    "Enzyklopaedie der Mikroskopischen Technik" (vol. 1).
British Museum—
    "Synopsis of Families and Genera of Nematodes." (Baylis and Daubney.)

Votes of thanks were accorded to the donors.

The **Treasurer** presented the Balance Sheet and Financial Report for the year 1925.

FINANCIAL REPORT FOR THE YEAR 1925.

Compared with the year 1924, the expenses for the year 1925 have been heavy, and there is a balance of Expenditure over Income of £2 0*s.* 2*d.*

Dr.

INCOME AND EXPENDITURE ACCOUNT

Dec. 31, 1924. £	s.	d.		£	s.	d.	£	s.	d.	£	s.	d.
162	16	0	To Rent and Insurance . .							165	16	0
431	1	2	,, Salaries and Reporting . .							408	18	1
			,, Sundry Expenses —									
			Library Books and Binding				19	6	9			
			Stationery and Printing .				101	15	11			
			Postages and Petty Expenses				50	6	0			
167	12	8								171	8	8
			,, Journal—									
			Expenditure—									
			Printing . .	749	6	8						
			Editing and Abstracting	76	19	0						
			Illustrating . . .	79	3	8						
			Postages. . . .	26	12	9						
							932	2	1			
			Less Receipts—									
			Sales	543	14	7						
			Advertisements . .	141	13	6						
							685	8	1			
205	0	8								246	14	0
.	.	.	,, Sheffield Conference							102	2	0
139	8	4	,, Balance, being Excess of Income over Expenditure							.	.	.
1105	18	10								£1089	18	9

Dr.

BALANCE SHEET AS AT

LIABILITIES	£	s.	d.	£	s.	d.
I. *Capital—*						
Being (*a*) Life Compounded Subscriptions received from 1st January, 1877, to 31st December, 1924	1860	17	6			
Add: Received during year to 31st December, 1925	23	12	6			
	1884	10	0			
and (*b*) Quekett Memorial Fund. Sum invested by Minute of Council dated 12th February, 1879	100	0	0			
				1984	10	0
II. *Sundry Creditors—*						
Subscriptions paid in Advance	47	3	4			
On account of Journal Printing, etc. . . .	190	5	6			
				237	8	10
III. *Income and Expenditure Account—*						
Being Excess of Income over Expenditure as at 31st December, 1924 . . .	108	10	7			
Less: Excess of Expenditure over Income (excluding Compounded Subscriptions as above) for the year to 31st December, 1925	2	0	2			
				106	10	5
				£2328	9	3

R YEAR TO 31ST DECEMBER, 1925. . Cr.

. 31, 1924. s. d.		£ s. d.	£ s. d.
	By Subscriptions (excluding Life Members' Fees)	819 5 11	
	„ for 1925, unpaid . . .	59 19 3	
6 14 1	„ Special Subscription	1 1 0	
			880 6 2
0 16 0	„ Admission Fees		92 8 0
12 3	„ Sundry Sales		1 10 6
7 16 6	„ Interest on Investment and Deposit A/c .		113 13 11
. . .	„ Balance, being Excess of Expenditure over Income		2 0 2
5 18 10			£1089 18 9

ST DECEMBER, 1925. Cr.

Assets.	£ s. d.	£ s. d.
I. *Furniture, Instruments, etc.*, as at 31st December, 1924.		216 13 6
I. *Stock of Screw Gauges* as at 31st December, 1924 . .		2 0 0
I. *Investments* as at 31st December, 1924		1772 0 0
£400 London & North Eastern Railway 3% Debenture Stock		
£500 Nottingham Corporation 3% Irredeemable Debenture Stock		
£915 11*s.* 4*d.* India 3% Debenture Stock		
£150 Metropolitan Water Board "B" Stock		
£421 1*s.* 5% War Loan, 1929-47		
£612 London Midland & Scottish Railway Co. 4% Preference Stock		
Note.—The market valuation of the above investments at 31st December, 1925, was £2038 19*s.* 8*d.*		
V. *Sundry Debtors*—		
Subscriptions unpaid	59 19 3	
On account of Journal Sales	171 5 3	
„ „ Advertisements	61 17 10	
		293 2 4
V. *Cash*—		
At Bank	32 15 0	
In Hand	11 18 5	
		44 13 5
		£2328 9 3

London, 15th March, 1926. We have examined the Books and Accounts of the Royal Microscopical Society for the year to 31st December, 1925, and have found the transactions correctly recorded and sufficiently vouched. In our opinion the foregoing Balance Sheet is properly drawn up so as to exhibit a true and correct view of the state of the Society's affairs, subject to it being noted that no account has been taken of the value of the Society's Library, Instruments and Stock of Journals (valued for Insurance at £3500).

(Signed) THOMSON McLINTOCK & CO.

Chartered Accountants, Hon. Auditors.

This amount, deducted from the credit balance of £108 10*s*. 7*d*. brought forward, leaves a balance of £106 10*s*. 5*d*. to the credit of Accumulated Income and Expenditure Account.

One Life Membership subscription has been received, and this has been placed to the credit of Life Membership Account, which now stands at £1884 10*s*.

Compared with a year ago, the income of the Society shows a further decrease, and this is entirely due to the decreased receipts from subscriptions, while the expenditure shows an increase of £128, mainly owing to the net cost of the Journal having risen by £40 and to the cost of the Sheffield Conference. The expenditure for the arrears of Library binding does not appear in the account, and this is now six years in arrear. Considerable expenditure under this head will fall to be paid in the near future.

The Society's securities, standing in the Balance Sheet at £1772, had had a market valuation on 31st December, 1925, of £2039.

The number of Fellows on the Roll of the Society on 31st December, 1925, was 546, made up as follows :—

Number of Fellows on the Roll of the Society at 31st December, 1924 .	545	
Ordinary Fellows elected during year .	43	
		588
„ „ resigned or removed during year . .	32	
„ „ deceased during year	10	
At 31st December, 1925		42

This total is made up of :—

(*a*) Ordinary Fellows	499	
(*b*) Life Fellows	32	
(*c*) Honorary Fellows	15	
		546

Mr. Hill moved, and **Mr. A. W. Sheppard** seconded :

"That the Financial Report be received and adopted."

Carried unanimously.

Mr. Scourfield moved, and **Mr. Oakden** seconded :

"That a very hearty vote of thanks be accorded to Messrs. Thomson McLintock & Co., Chartered Accountants, for their services as Honorary Auditors to the Society."

Carried unanimously.

The following papers were read and discussed :—

Mr. J. E. Barnard, F.R.S., F.Inst.P., F.R.M.S., and Mr. John Smiles, A.R.C.S., F.R.M.S.—
"Some Observations on the Morphology of the Pleuro-pneumonia Organism."
Mr. F. Welch, F.R.M.S.—
"Microscopical Demonstration of the Pleuro-pneumonia Organism."

Hearty votes of thanks were accorded to the authors of the above papers.

The business proceedings then terminated.

AN ORDINARY MEETING

OF THE SOCIETY WAS HELD AT 20 HANOVER SQUARE, W.1, ON WEDNESDAY, MAY 19TH, 1926, DR. JAMES A. MURRAY, PRESIDENT, IN THE CHAIR.

The Minutes of the preceding Meeting were read and confirmed.

The nomination papers were read of four Candidates for Fellowship.

New Fellows :—

The Rev. J. J. R. Armitage,
Mr Henry C. Blunderfield,
Mr. Thomas G. Brooker,
Mr. John H. W. Chivers.
Mr. Kenneth E. Lohman,
Mr. Alfred S. G. Mardon,
Mr. S. R. Nair, B.Sc.
Mr. Robert H. Pledger. B.Sc.
Mr. S. G. Manavala Ramanujam, M.A.
Mr. Hubert V. Sheard,

were elected as Ordinary Fellows of the Society.

A Donation was reported from :
Messrs. Longmans, Green and Co.—
"The Nervous Mechanism of Plants." (Bose.)
A vote of thanks was accorded to the donors.

The following papers were read and discussed :—
Dr. James C. Mottram, F.R.M.S.—
"A Note on the Effects of β-Radiation on *Colpidium colpoda* as seen in Stained Specimens."
Miss Joyce F. Raves, M.Sc.—
"Mitosis in *Anacylus Pyrethrum.*" (Communicated by Professor R. Ruggles Gates, M.A., Ph.D., F.L.S., F.R.M.S.)

Votes of thanks were accorded to the authors of the above papers and to Professor Ruggles Gates.

The business proceedings then terminated.

JOURNAL
OF THE
ROYAL MICROSCOPICAL SOCIETY.
SEPTEMBER, 1926.

TRANSACTIONS OF THE SOCIETY.

XII.—JOSEPH BANCROFT READE: HIS CONTRIBUTIONS TO MICROSCOPICAL SCIENCE.

"Mit mehr Erfolg soll Reade in England 1837 Mikrophotographien auf Chlorsilberpapier erhalten und dies Verfahren im Jarhe 1839 noch verbessert haben."*

By CHARLES H. OAKDEN, F.R.M.S., Hon. Mem. R.P.S.

(*Read June* 2, 1926.)

ONE PLATE AND FOUR TEXT-FIGURES.

"A MICROPHOTOGRAPH is a very small photograph of a large object, and a photomicrograph an enlarged photographic representation of a microscopic object by means of a microscopic objective." In these words Shadbolt (President, R.M.S., 1856–7) defined and delimitated the product of the process which has played so important a rôle in recording microscopical advance.

Both microphotography and photomicrography are arts of English origin, the former, with which we are not concerned, as it is no longer practised in this country, being the invention of an optician, John Benjamin Dancer, a Londoner, who settled in Manchester.

Photomicrography was a natural corollary to the invention of the Solar Microscope in 1738 by Dr. Lieberkuhn (*6*) †—which he exhibited to several members of the Royal Society and to Mr. Cuff, Mr. Adams and other opticians, when he visited London early in 1738.

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* (With more success Reade in England (1837) obtained microphotographs on silver chloride paper, and in 1839 this method was still further improved upon. "Die Mikrophotographie," von G. Marktanner-Turneretscher.)

† The italic figures within brackets refer to the Bibliography at the end of the paper.

Sir David Brewster describes it as a well-known popular instrument for exhibiting on a white screen in a dark chamber magnified images of minute objects illuminated by the condensed light of the sun.

But a considerable period elapsed before the preparation of permanent photomicrographs was achieved by the Rev. Joseph Bancroft Reade, one of the founders of the R.M.S., with the birth of which this feat synchronized. In order to visualize the position when Reade entered the arena it is not necessary to go quite as far back as the ancient Egyptians, who, according to Dr. Vogel, utilized the darkening action of light upon silver nitrate in tracing hieroglyphics upon the mummy cloths. The first recorded note of experimental work on the subject is that of Schultze (*10*), who in 1727, when saturating with chalk some aquafortis containing a very small quantity of silver particles before an open window, was surprised to see the surface change to a dark red, inclining to purple. He then placed his solution in two bottles and found that no change took place in darkness, and that the heat of the kitchen fire produced no effect. The solution, when placed in a window, darkened on the side exposed to the light, but remained unchanged on the other. He demonstrated this to his friends, but made no effort to produce a permanent result, for he simply shook up the bottle to repeat the experiment and left it to others to investigate the subject.

Dr. William Lewis, of Kingston-upon-Thames, repeated Schultze's experiment, and investigated the causes of the coloration of various substances treated with silver nitrate and exposed to sunshine. After his death in 1781 his assistant, Chisholm, entered the service of Josiah Wedgwood, the potter, who purchased the manuscript records made by Dr. Lewis.

Wedgwood's fourth son, Tom (*18*), was early acquainted with the camera obscura, his father having used one when visiting Russia; and in 1800 Leslie, who had been Tom's tutor, reported that an object-glass for a solar microscope had been left at Wedgwood House, York Street, St. James's. It is fair to assume, therefore, that Tom was acquainted with both instruments, and that Chisholm, during several years, rendered him assistance and advice with regard to chemical matters; and it is greatly to be regretted that the records of his experiments are so meagre (*18*, *11*). They are contained in a paper read in 1802 at the Royal Institution, entitled, "An Account of a Method of Copying Paintings upon Glass, and of making Profiles by the Agency of Light upon Nitrate of Silver; invented by T. Wedgwood, Esq. With Observations by H. Davy." It appears that Humphry Davy—afterwards Sir Humphry Davy—who became an assistant lecturer at the Institution, arrived in London to take up his duties in the early part of 1802, and learning the results of Wedgwood's experiments

THE REV JOSEPH BANCROFT READE

leemed them to be of sufficient importance to bring before the public. Wedgwood's first experiments were with the camera obscura and paper washed over with silver nitrate. For some purposes he found white leather to be preferable to paper, because t was more sensitive—the tanned gelatin no doubt acting as an accelerator. The images, however, were too faint to produce any effect upon the nitrate of silver in a measurable time; he therefore turned his attention to the solar microscope, and found that images of small objects (which are not named) could be copied without difficulty; but it was necessary that the paper should be a short distance from the lens. Attempts to fix the pictures were made by repeated washings with water, without result. Davy, in conclusion, says: "Nothing but a method of preventing the unshaded parts of the delineation from being coloured by exposure to the lay is wanting to render the process from being useful as it is elegant." He further said that he had imagined some experiments on the subject and hoped to publish them later, but nothing further appeared. Wedgwood's health was indifferent and he died four or five years later; and Davy's duties probably prevented him from devoting the necessary time to solve the problem alone. It is clear from the above that Wedgwood experimented with photomicrography, but failed to produce any permanent result.

During the three decades following 1802, whilst the chemists were pursuing their investigations, the opticians improved the solar microscope, and in compliance with the demand which arose the ordinary or table microscope was also improved, with the resulting production of forms capable of being used for photomicrography, and upon which modern instruments are based. Considerable attention was devoted to the improvement of objectives, and new forms, proposed by Joseph Jackson Lister, were at once adopted. On the chemical side two items are of special interest. Sir John Herschel's paper entitled, "On the Hydrosulphurous Acid Compounds," appeared in 1819 (*8*), and described the solvent action of hyposulphites on silver salts; and it is curious to note that no use appears to have been made of that property until Reade's attention was directed to it some twenty years later. Herschel eventually produced a silver chloride process, which he described to the Royal Society on 4th March, 1839, and he was the first worker to take a photograph on glass.

During 1825–1827 Nicephore Niepce (*3*) produced successful results, and printed from metal plates coated with bitumen, which, after exposure to light, were etched, thus laying the foundation of photo-engraving.

The decade 1830–1840 was a very crowded and important one. Niepce in 1829 became partner with Louis Daguerre, and upon the death of Niepce his place was taken by his son Isidore. Upon learning the details of the elder Niepce's labours Daguerre worked "with fury," but after a time resolutely struck out a new and independent line, and in 1835 he announced to his partner Isidore his impending success. Two years further were spent in perfecting the details, and Daguerre then succeeded in interesting Professor Arago, the noted astronomer, in his process. On the 19th August, 1839, Arago announced the details of the process christened Daguerreotype before the Academy of Science. Although Daguerre in 1838 attempted without success to float a company to exploit his process, rumours concerning it reached this country and stimulated three independent English workers to record their work.

The first, William Henry Fox Talbot (*4*), commenced his experiments in 1834, when he (*14*) successfully adapted the polariscope to the microscope, and read two papers (*15*) (*16*) upon his observations with regard to the properties of certain crystals before the Royal Society. He also worked with a solar microscope, which is now in the possession of the Royal Photographic Society. His process was described before the Royal Society on 31st January and 21st February, 1839, six months before Daguerre's process was revealed. Dr. L. Beale is probably correct in stating that Fox Talbot was an authority upon the employment of photography for taking microscopic objects, but no record of any photomicrographs made by him has been traced.

The second, Sir John Herschel, has already been referred to The third investigator—the one with whom we are now chiefly concerned—was the Rev. Joseph Bancroft Reade, who was born at Leeds on 5th April, 1801. He was educated at the Grammar School in that city and afterwards at Trinity College, Cambridge, where he took an Arts degree. He subsequently obtained a scholarship at Caius. Ordained in 1826, he became Incumbent of Harrow Weald, 1832–1834, and Vicar of Stone (Bucks), 1839–1859. He was Rector of Ellesborough (Bucks), 1859–1863, and Rector of Bishopsbourne (Kent), 1863–1870. He was elected a Fellow of the Royal Society in 1838, and was one of the founders in the following year of the Microscopical Society of London. In 1869–70 he became the fifteenth President of the now "Royal" Microscopical Society, and was also a Vice-President of the Photographic Society, holding both offices at the time of his death—12th December, 1870.

Some difficulty has been experienced in filling the gap between the years 1834 and 1839 in the above record. The list of Fellows of the Royal Society showed that Peckham was a sufficient address for Reade. Upon referring to the histories of Camberwell, Reade's name did not appear in any of the indexes, but upon perusal of the earliest of these histories (*1*) a chapter headed "Peckham School" was found, from which the following has been extracted. It was "a very respectable establishment, opposite the end of Rye Lane," founded in 1788 by the Rev. Martin Ready and carried on by him until his death in 1805, when it was continued by his son, Mr. Thomas Martin Ready. "It since belonged to the Rev. J B. Reade, whose name is connected with some highly interesting facts relating to fossil infusoria in the Appendix to Mantell's 'Wonders of Geology' (*27*). The present (1841) proprietor is Mr. Holt. Many youths educated at this school have become eminent in after life, and a few have taken a high degree as Wranglers at the Universities." Peckham at that period was a very different place from what it is to-day, being then a typical country village, situated in the midst of market gardens, grazing land and cornfields. The front of Reade's school-house having a southern aspect, he had no difficulty in making use of sunlight for his solar microscope, with which he did his important work in 1837-1839.

Professor Quekett makes the earliest reference to Reade's microscopical work (*13*). He states that in 1835 Reade first directed the attention of microscopists to the siliceous skeletons of certain parts of grasses. The specimens first examined by him consisted of the husks and parts of the stem of the wheat and the oat; they were prepared by subjecting the parts to a very high temperature in a platinum crucible, whereby all the carbonaceous matter was burnt off and an ash of silica was left; this was removed and mounted in Canada balsam, when on microscopic examination a perfect cast in flint was displayed, even of the most minute vegetable structure. Reade later modified the process and adapted it to the examination of delicate vegetable structures, and on 21st July, 1841, he read before the Society a paper entitled, "The Process of Charring Vegetable Tissue, as applied to the Examination of the Stomata of Garden Rhubarb" (*21*).

In December 1836 Reade made a communication (*20*) which was read before the Royal Society, in which he described his method of using a hemispherical lens 1¾ in. in diameter with a convex solar condenser. A beam of solar light, containing both light and heat rays, after it had been converged to a focus by the first condensing lens, passed through the second, placed at a short distance from the focus of the first, so that on emergence from the second the heat rays were collected into a focus more distant from the condenser than the focus of the light rays, forming a brilliant cone of light within the cone of heat rays, without manifesting any sensible degree of heat, such as would produce injurious effects upon objects in Canada balsam, or on living animals exposed to its influence. He notes elsewhere that he made the above discovery, which was the optical key to his success, whilst experimenting in photography, and states (*38*) the arrangement in 1837 did him good service, as it gave great light with little heat, and that for the first time Ross's cemented powers were used with safety with the solar microscope.

The method of using the solar microscope was well known before this period. As early as 1776 Ledermuller published a plate (*9*) showing a Cuff solar microscope being used in a darkened room; the microscope being attached to an opening in the window or wall with the long mirror outside, in such a way that the image of the object was projected upon the light-coloured wall of the opposite side of the room, or intercepted upon a smaller scale by some translucent material attached to a frame fixed at the top of a movable stand (fig. 1). No description of Reade's solar microscope has been traced, but it is gathered (*14*) that it had a chamber of sufficient size to enable him to put his head in to keep his paper wet, and to observe the progress of the forming image, for he definitely (*19*) says, "I was virtually within my camera standing between the object and the prepared paper."

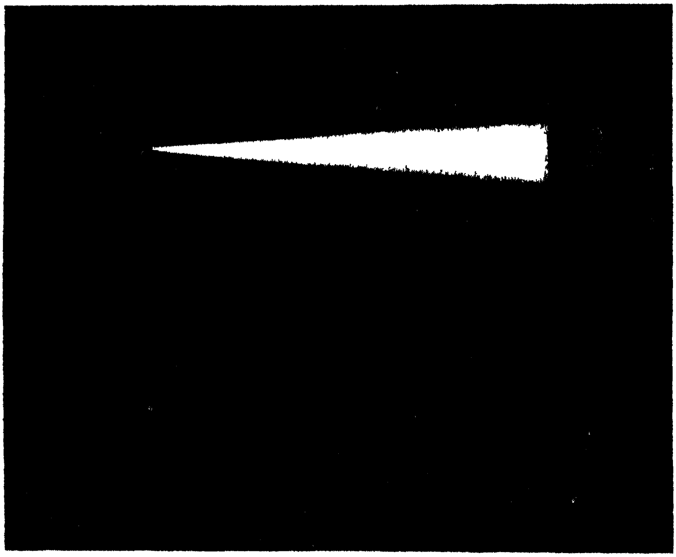

FIG. 1.

Having surmounted his optical difficulty, Reade turned his attention to the chemical problems connected with (*a*) the utilization of the properties of gallic acid—in the form of infusion of galls—in conjunction with salts of silver coated upon paper and acted upon by light; and (*b*) the fixation of the images obtained by the solar microscope. These images he first called "solar mezzotints," and later "photogenic drawings"; at that date the term "photograph" had not been coined by Sir John Herschel.

The story of the use of his wife's kid gloves has been variously recorded, but Reade's own account is available (*19*). He says: "Mrs. Reade was so good as to give me a pair of light-coloured kid gloves, that I might repeat Wedgwood's experiment, and as my friend Mr. Ackerman reminds me, her little objection to let me have a second pair led me to say, 'Then I will tan paper.' Accordingly, I used an infusion of galls in the first instance in the early part of 1837, when I was engaged in taking photographs of microscopic objects." It appears that Reade's experiments with gallic acid occupied some time. He states that he was in "the agony of a find," his paper was "unwilling," and after "a weary while" he was successful.

Reade gave no public description of his work, unless he did so at the meeting of the Royal Society on 23rd April, 1839, when he showed his results. This led to his being invited to attend a soirée on the 27th April, 1839, given by the Marquis of Northampton, the then President of the Royal Society, when Fox Talbot also exhibited his pictures.

Reade first described his process in a letter dated 9th March, 1839, addressed to E. W. Brayley, who was for many years the Librarian at the London Institution. He also described it in the same year in letters sent to his brother in Leeds, and to a Mr. Reeve, who cannot now be identified.

Brayley, in April and May, 1839, delivered two lectures upon the subject, and illustrated the process by experiments described at the London Institution and at Walthamstow, but no reports of those lectures appear to have been made.

In the letter to Brayley, Reade writes (*23*):—"The most important process, and one probably different from any hitherto employed, consists in washing good writing paper with a strong solution of nitrate of silver, containing not less than eight grains to every dram of distilled water. The paper then prepared is allowed to dry gradually, after being placed in the dark. When perfectly dry and just before it is used, I wash it with an infusion of galls prepared according to the Pharmacopœia and immediately, even while it is yet wet, I throw upon it the image of the microscopic objects by means of the solar microscope. The drawing (photograph) of the flea was perfected in five minutes, and the section of cane and the spiral vessels of the stalk of common rhubarb were accomplished in about eight to ten minutes, and were fixed by hyposulphite of soda." (*26*) (*24*) (*32*) (*33*). Another subject was *Trientalis Europeæ*. The magnification of the photographs he made were fifty to one hundred and fifty diameters. He learned of the properties of hyposulphite of soda from a reference to Sir John Herschel's paper written in 1821 in Brande's "Chemistry," and was the first person to make use of it in photography.

The photomicrographs used by Brayley at his lectures were exhibited at Lord Northampton's soirée and left with his lordship at the close of the evening. Besides these (*25*) Reade gave others away when he left Peckham to take up the living at Stone in 1839, and for charitable purposes at Leeds. Referring to the latter, an anonymous writer in 1864 says:—(*2*) " . . . and a bazaar in Leeds in 1839 to which some of these pictures were sent was the first occasion on which photomicrographs were offered for sale."

A photomicrograph (*26*) of a longitudinal section of the tooth of *Lamna* (*elegans*) by Reade (fig. 2) was copied on zinc by Mr. Lens Aldous, and used by Professor Owen as one of the plates in his work on "Odontography"—plate 6 states that it was published in 1840, and that it was from a solar microscope photograph by the Rev. J. B. Reade in the possession of the author. Another photomicrograph—the head of a flea mounted in balsam—was lithographed by the same artist (*30*). A copy of this was presented on Reade's death to the Microscopical Society (*33*).

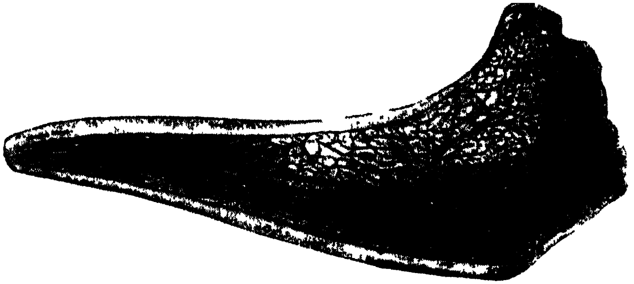

Fig. 2.—Section of Tooth of Lamna, from a solar photomicrograph by Rev. J. B. Reade.

(Reduced from Owen's "Odontography.")

A good deal of time has been expended without result in endeavouring to trace some original paper negatives of Reade's. In a letter probably written in the sixties, quoted in 1890 by John Werge (*29*), without date or source of earlier publication, Reade says: "Two of my solar microscope negatives taken in 1837, and exhibited with several others by Mr. Brayley in 1839 as illustrations of my letter and his lecture at the London Institution, are now in the possession of the London Photographic Society." Werge later in his book says: "I regret I am unable to trace the existence of these two negatives. . . . Mr. Reade told me himself he gave these two historic negatives to Dr. (Hugh W.) Diamond when Secretary (1858–1868), . . . but they are not now in the possession of the Society, and what has become of them no one knows. Several years ago I caused enquiries to be made. Dr. Diamond was written to by Mr. H. Baden Pritchard (son of

Andrew Pritchard), then Secretary (1873–1878), but Dr. Diamond's reply was to the effect that he had no recollection of them." It would appear from the above that "the micro-photographs exhibited at Lord Northampton's in 1839 remained in his lordship's possession" (*26*) and were subsequently returned to Reade. Reade initiated Dr. Diamond in the art of photomicrography. The former had "as a photographic pupil" a Mr. Redman, of Peckham, who communicated Reade's process to Sir John Herschel (*29*).

In 1836 Reade referred (*20*) to examining "animalcula" with the solar microscope, and from a later paper (*28*) read before this Society, it was found that *Hydra viridis* and *Volvox globator* were among them, and that he had no difficulty in photographing them with direct solar light, although he failed with dark-ground illumination. From which it is clear that he was not only the first successful photomicrographer, but also the first to photograph living microscopic objects.

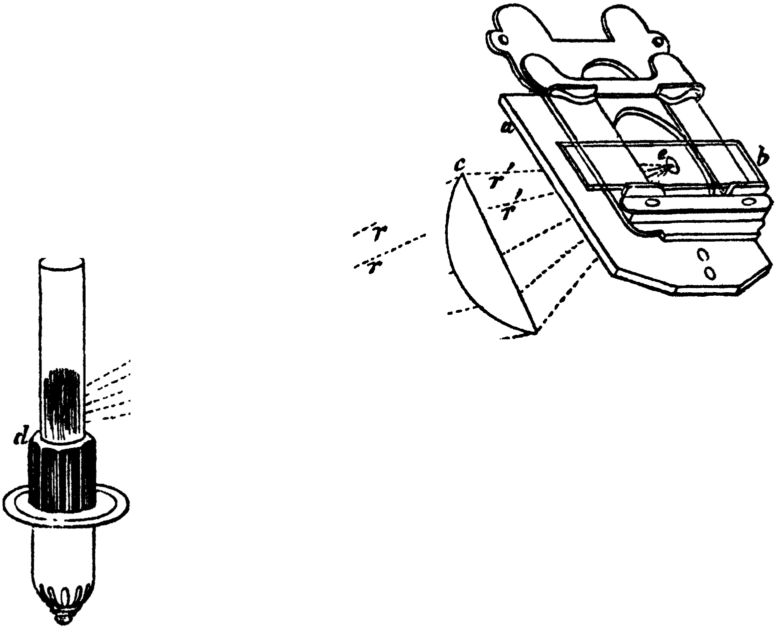

FIG. 3

There is no record of any photomicrographic work by him after he left Peckham, but Professor Quekett refers (*13*) to a method of illumination introduced by Reade in 1838, who called it "Background Illumination." Quekett fully describes it and publishes an illustration. An oblique beam of light, after passing through a condenser, was made to impinge on to the back of a slide upon the microscope stage in such a way that only the rays falling indirectly upon the object passed into the microscope tube (fig. 3).

No photomicrographs were shown at the International Exhibition of 1851, but Reade there exhibited two solid astronomical eye-pieces, each consisting of three lenses cemented together. For these he received the bronze medal—the only award.

In 1860 Reade adapted his hemispherical condenser to the table microscope (*28*), first with two lenses and later with three, forming what he described as his "kettledrum." The "flute key arrangement" appears to have been a slip of stops or diaphragms used with the condenser. He exhibited the condenser (fig. 4) at the International Exhibition of 1862, and received "Honourable Mention." An illustration of the condenser appears in the Official Catalogue, and another as it was issued by Ross in Davis's "Practical Microscopy" (2nd Edition), p. 68.

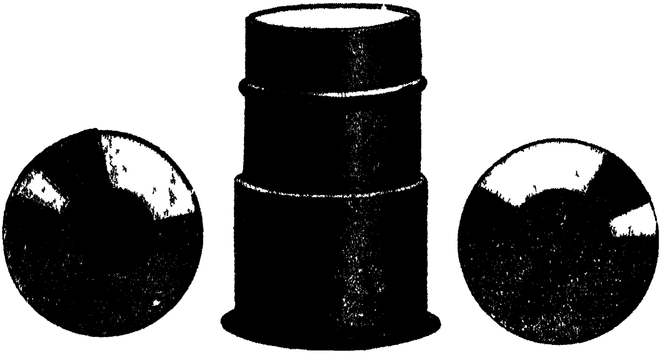

FIG. 4.

In 1869 Reade described the use below the stage of the microscope of an equilateral prism 1½ in. in length, with 1 in. faces or even ½ in. faces, which he suggested should be mounted in a cradle above a ball-and-socket joint, with the addition of a jointed arm, and if necessary a clamping screw to keep it in position, for resolving the markings on the valves of diatoms and the structure of the Podura scale. This he called a "Diatom Prism," and by its use he produced a new method of illumination and obtained new results (*29*).

In his presidential address to the R.M.S. (1870) he announced his gift of his copy of the "Philosophical Transactions" to the Library of the Society.

Reade's last paper communicated to our Society was entitled "Note on Fluorescence v. Pseudo-dichroism," and was dated from Bishopsbourne Rectory, November 7th, 1870. His last letter to Dr. Charters White has a footnote, "You might send this note to the Journal as a preface to yours. I am so weak that a friend writes for me" (*31*).

He passed away on the 12th December, 1870, bequeathing to the Society his Dolland microscope, "a replica of one given to him when 15 years of age by his father," together with the only 1/30th objective made by that maker. Werge, who knew him, describes him as having been "a kind and affable man."

It has been the good fortune of this country, beyond all others, to produce scientific amateurs who have notably contributed to the increase of natural knowledge and the improvement of scientific methods Reade was such a man; and the memory of a worker of his type is still worthy of high honour.

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XIII.—MITOSIS IN ANACYCLUS PYRETHRUM.

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(*Read May* 19, 1926.)

FOUR PLATES AND TWO TEXT-FIGURES.

INTRODUCTION.

THE paper is an account of an investigation into the cytology of somatic division in *Anacyclus Pyrethrum DC.*, a member of the group *Anthemideæ* of the natural order *Compositæ*. This plant was chosen from among a number of other members of the order as being the most suitable of all those examined for such an investigation. The account is followed by a short discussion on certain questions raised as a result of the investigation. It is supplemented by figures showing the more important stages of mitosis.

A selection was made of a number of members of the *Compositæ* belonging to different groups. The seeds of these plants were obtained from Kew. They were grown to the seedling stage; root and shoot tips were then fixed, embedded, sectioned, and stained. The various preparations were then examined and compared with respect to the size of the nuclei and of the chromosomes, in order to find out which species would be most suitable for detailed cytological investigation. Of all the species examined, *Anacyclus Pyrethrum DC.* seemed to lend itself most favourably for investigation. The nuclei were larger than in most of the other plants. The chromosomes were long and large, showing distinct differences in size and shape; they were also fairly well defined, unlike those, for example, of the *Crepis* species, which always have a "woolly" appearance. The chromosome number was fairly low as compared with that of some other species. The shoot tips of this plant proved particularly good material, since a large part of the apex remains meristematic, whereas in some of the other forms only a few cells of this region would be actively dividing at any one time. *Anacyclus* moreover grew extremely rapidly. The chief disadvantage was the minute size of the root tips, which were so thin as to be almost invisible when in xylol or paraffin, unless they were stained or darkened by the fixative used.

METHOD OF INVESTIGATION.

The seeds were grown on damp blotting-paper in Petri dishes, which were tilted so that the roots grew downwards in one direction and the shoots upwards. By this means the roots were kept fairly straight and quite clean. The germinating seeds were kept in a dark, warm place. When the roots were about a quarter of an inch in length, and the cotyledons were still pressed tightly together round the shoot apex, root and shoot tips were cut off and fixed. In the case of the shoots, part of each cotyledon was removed in order to facilitate fixation. The fixation was usually carried out between noon and 2 p.m., as it was found, after trying at all times of the day, that the cells were dividing most actively at about that time. The fixatives used were Flemming's fluid, both weak and strong solutions, Hermann's fluid, Merkel's fluid, acetic alcohol, Bouin's fluid and Allen's modification of Bouin's fluid. The material was cleared in xylol, and kept in changes of paraffin for 6-12 hours. In cold weather it was found best to use wax of about 48° C. M.P., while in warmer weather 52° C. M.P. wax was not too hard. Sections were cut as a rule at a thickness of 6μ. The chief stains used were Heidenhain's Iron-alum Hæmatoxylin, counter-stained with Licht Grün or Orange G, Flemming's Triple and Breinl.

It was found that whereas weak fixatives, e.g. Flemming's weak solution, were better for shoot tips, stronger solutions were necessary for the roots, penetration evidently being much easier through the cuticle of the shoot apex than through that of the root. On the whole, the material was best fixed with Flemming's strong solution, although it was found almost impossible to bleach sufficiently after using this fixative. Hermann's fluid also proved very good, as it tended to shrink the chromosomes very slightly, making them appear more sharply defined. This was a great advantage, for in nearly all plants of this order the chromosomes tend to be "woolly" and indefinite.

The advantage of using shoot tips lies in the fact that in a single section cells may be found dividing in all planes; thus transverse views of the division may be obtained as well as longitudinal, whereas if roots be used it is necessary to cut both transverse and longitudinal sections in order to obtain these figures. The root, however, proves more convenient in many respects. The cells are square or rectangular in section, and not irregular in shape as in the shoot, and the cytoplasm does not contain many extranuclear bodies, such as chloroplasts, which are often found in the cells of the shoot apex, and which complicate observations. Also in roots it is nearly always possible to tell in which direction a nucleus will divide, while in the shoot tip division may occur in any plane. The roots, on the other hand, need very careful handling, being easily bruised For these reasons both root and shoot tips were examined in the investigation of *Anacyclus Pyrethrum.*

DETAILS OF MITOSIS.

Resting Stage.—During the resting stage the nuclei are large and almost spherical, and are often surrounded by a clear zone, where the cytoplasm stains less darkly than nearer the cell wall. Although the nuclear material is sharply divided from the cytoplasm, in no case can a definite stainable nuclear membrane be seen. The linin reticulum and nucleoplasm, though they stain very faintly, seldom appear quite uniform, darker spots being nearly always visible, so that the nucleus has a somewhat coarsely granular appearance. There is no clear distinction between the linin reticulum, which is probably superficial, and the granular nucleoplasm. The nucleolus is fairly large, darkly stained, and surrounded by a hyaline region, which is generally regarded as the result of contraction of the nucleolus in fixation, and is fairly sharply divided from the granular nucleoplasm (fig. 2). The nucleolus may sometimes be lobed, or represented by several small nucleoli, this condition being particularly common in cells of the shoot apex, or at the tip of the root. In such nuclei, each small nucleolus is surrounded by a separate hyaline zone, these zones being divided from one another by a layer of granular nucleoplasm (fig. 1). Before division the small nucleoli usually come together like drops of oil to form one large almost spherical nucleolus. This large nucleolus is surrounded by a hyaline zone which almost fills the nucleus, the granular nucleoplasm and linin network being apparently pressed to the outside. The nucleolus frequently contains in the centre, or nearer to the surface, a refractive body, crystalline in structure (figs. 3, 5). This body can be demonstrated by various combinations of fixatives and stains, and may be of the nature of a crystalloid.

Prophases.—At an early stage, darkly staining bodies appear in the linin (fig. 2). They are at first relatively few in number, but at a later stage are smaller and more numerous, possibly by division or by diffusion into the linin reticulum (fig. 3). These chromatic bodies are occasionally paired. They become arranged in parallel linear series, usually along the long axis of the cell, in the direction in which division will take place (fig. 4). The substance of the chromatic bodies becomes more evenly distributed along the linin, so that a more uniform thread is formed. The thread at this stage appears blurred, and this in spite of every care in fixation; in fact, it is only in well-fixed material, judging by other nuclei in different stages, that this condition of the thread is observed. The thread is also vacuolate and appears double in parts (fig. 5). The nucleolus now becomes much fainter in staining reaction, while the thread becomes more deeply stainable and loses its indefinite vacuolate appearance. The thread has never been seen to be connected in any way with the nucleolus, though the latter is in many cases not quite central in position. The thread is now thinner and waved in outline, and for a short time shows no indication of a split (fig. 6). It then becomes straighter, thicker, and more deeply stained, and again shows a very definite split. The portions of the thread are arranged parallel to one another from pole to pole of the nucleus around the central hyaline region, the nucleolus becoming ever less and less stainable (fig. 7). In those cases when more than one nucleolus is present the chromatic thread does not appear to be confined to the surface of the nucleus, but portions of it pass between the small nucleoli. The number of parallel portions of thread stretching the whole length of the nucleus seems to be approximately equal to the number of chromosomes. The thread now begins to separate into chromosomes, apparently breaking apart, at the poles of the nucleus, usually at one end before the other. In some cases, looped portions of chromosomes can be seen at one end, while their free ends are visible at the other end (figs. 8, 9).

Metaphase.—As the nucleus approaches the metaphase condition it is very noticeable that all the long ends of the chromosomes are extended towards one pole of the cell, where they first appeared to break apart, while at the other end they are curved (fig. 10). In very few of the division figures studied in well-fixed material can a distinct spindle be seen. The cytoplasm frequently stains more deeply in this region, and appears as though it were being subjected to tension in the direction in

EXPLANATION OF PLATE XVI.

Note.—The following abbreviations are used for the names of fixatives and stains:—

Fixatives.—Flemming's weak solution—Fw. Flemming's strong solution—Fs. Hermann's solution—H.

Stains.—Flemming's triple—Ft. Heidenhain's iron-alum hæmatoxylin—Hh.

Fig. 1.—Resting nucleus of shoot tip with two nucleoli, showing hyaline zones round the nucleoli, and round the whole nucleus. (Fw., Hh.)

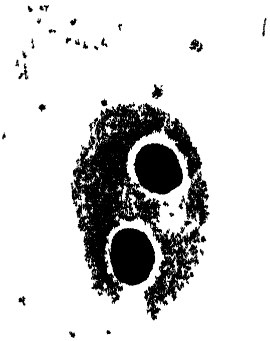
Fig. 2.—Nucleus of root tip, showing large chromatic granules. (Fs., Ft.)

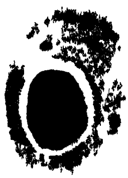
Fig. 3.—Nucleus of root tip, showing granules increased in number and diminished in size, and the crystalloid-like body in the nucleolus. (Fs., Ft.)

Fig. 4.—Nucleus of root tip, showing granules arranged in linear series. (Fs., Ft.)

Fig. 5.—Nucleus of root tip, showing "woolly" stage in formation of parallel spireme threads. (Fs., Ft.)

Fig. 6.—Half nucleus of root tip, showing "waved" appearance and deeper staining capacity of threads. (Fs., Ft.)





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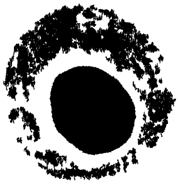

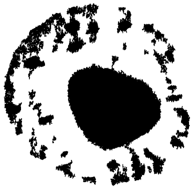

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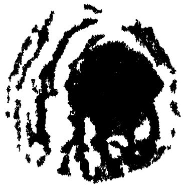

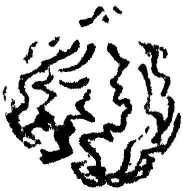

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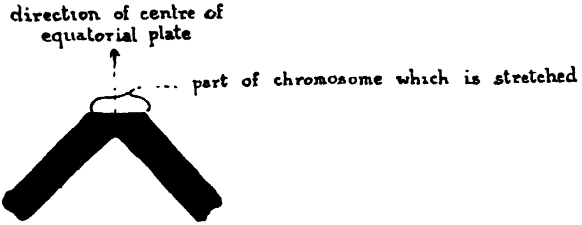
which cell division should occur, but no definite continuous fibrils have been observed. In the older parts of roots and shoots, however, where the cytoplasm has become ragged, it often appears to have contracted into a dense mass, in the shape of a spindle. In such a mass as this definite "spindle fibres" may be seen, but seldom in well-fixed cytoplasm.

When the chromosomes come to lie in the equatorial region, their ends are as a rule first directed towards one pole (fig. 13). The chromosomes then move so that their whole length is in the plane of the equatorial plate. The majority are long and curved and show a longitudinal split. At this stage the structure of the chromosomes can be seen best in a section parallel to the plane of division, where the equatorial plate is in surface view. The chromosomes are at first fairly thin and somewhat beaded, showing their double nature at the ends which are slightly split apart, and also by vacuoles and splits which occur in them (fig. 11). They then become much shorter, and of a more even thickness, and lie entirely in the equatorial plane (fig. 12). When lying in this position the chromosomes may easily be counted. There are 18. This number is in accordance with the observations made by Winge (*8*),* who claimed in 1917 that the cardinal number for the group Anthemideæ is 9. At this stage it is always noticeable that the long-curved chromosomes have their bends towards the axis of the spindle—that is, the centre of the equatorial plate—while the straight chromosomes lie directed towards that point. The chromosomes appear plastic, since in the case of the long-curved ones the limit of the chromosome on the outside of the bend seems to be stretched tight, as though subjected to considerable tension owing to the bending, while there is a sharp angle at the inside of the curve. In this way a constriction is caused at the point of bending. (Text-fig. 1, and fig. 12).


direction of centre of equatorial plate
part of chromosome which is stretched

TEXT-FIG. 1.—Showing constriction of chromosome.

By the time that the metaphase condition is reached, no trace of the nucleolus can be seen; faintly staining oily globules are sometimes visible in the cytoplasm, and these may be derived by fragmentation of the nucleolus. The history of the nucleolus cannot be followed through the metaphase and anaphase stages, since it has then either disappeared or almost entirely lost its staining capacity. Before the chromosomes split they move so that they no longer lie entirely in the plane of the equatorial plate, but their ends protrude on both sides (figs. 14, 15).

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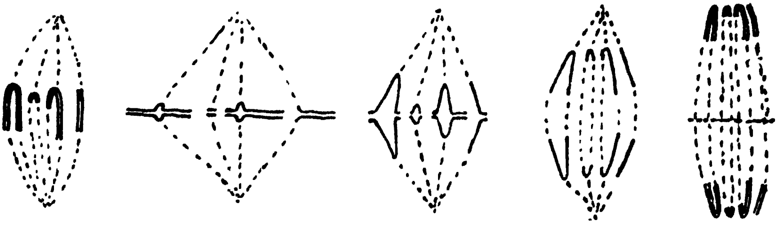
* The italic figures within brackets refer to the Bibliography at the end of the paper.

Anaphase.—When the halves of the chromosomes begin to separate, the long ones usually split first in the middle or slightly towards one end, remaining attached to one another at both extremities for some time. Some of the shorter straight chromosomes split apart at one end first. The point at which splitting first occurs is always the point which is drawn first to the poles of the spindle. Thus some chromosomes after separating become V-shaped, and others, the shorter ones, remain straight. Quite late in anaphase the chromosomes which have separated can be seen opposite to one another in the daughter chromosome groups (fig. 17, and text-fig. 2).



TEXT-FIG. 2.—Showing splitting of chromosomes.

In the case of the V-shaped and hooked chromosomes, there sometimes appears to be a slight constriction at the bend, similar to that observed in the parent chromosomes on the equatorial

EXPLANATION OF PLATE XVII.

Fig. 7.—Nucleus of root tip, showing parallel banding of spireme with split. (Fs., Ft.)

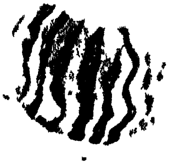
Fig. 8.—Half nucleus of shoot tip, showing characteristic arrangement of loops of spireme at one end only. (Fw., Hh.)

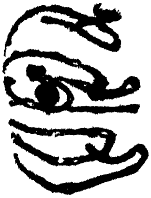
Fig. 9.—Nucleus of root tip, showing parallel banding, and looping of threads at one end. (H., Hh.)

Fig. 10.—Chromosomes of cell of root tip, formed from the looped threads, showing the free ends all pointing in one direction, the nucleolus having by this time completely disappeared. (Fw., Hh.)

Fig. 11.—View of the equatorial plate in cell of shoot tip, showing irregular shapes of chromosomes, their double nature being indicated by their split ends. (Fw., Hh.)

Fig. 12.—View of equatorial plate in cell of shoot tip, showing contraction and later arrangement of chromosomes in the equatorial plane. (Fw., Hh.)





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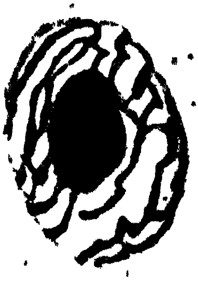

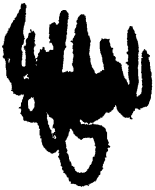

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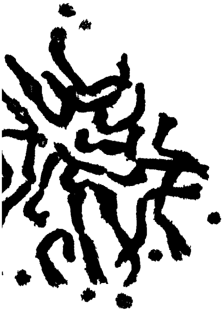

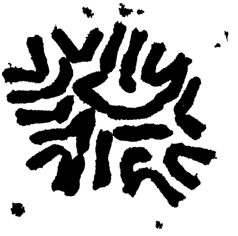

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plate Some of the chromosomes are lobed, having portions which are attached only by a very fine neck, so that they could easily be broken off (fig. 13). The chromosomes are evidently drawn to the poles of the spindle very rapidly, for in only a few preparations is this stage of division found.

Telophase.—On arriving at the poles the chromosomes are much nearer together at the side further from the equatorial region. They become very much thicker and begin to lose their sharp outline (fig. 18). They are drawn together so as to be parallel to one another, and seem to become connected laterally, while at the same time they show an indication of a split (figs 20, 21). The daughter nuclei then become rounded off from the cytoplasm, although no distinct nuclear membrane can be seen. The chromosomes lose their continuity and appear as linear series of chromatic granules, the chromatic material always being more densely massed together at the end further from the plane of division (fig. 22). It is from this region of the daughter nucleus that the nucleolus begins to be re-formed. Two or more faintly staining globules appear at first; these slowly run together like oil drops and form a large nucleolus which is at first lobed and vacuolate (figs. 22, 23, 24), but which later becomes spherical and more densely stainable. Sometimes the small nucleoli do not fuse, and the resting nuclei thus produced contain several nucleoli. The chromatic bodies meanwhile become smaller and more numerous, more evenly distributed and fainter in staining reaction (figs. 23, 24). It finally becomes impossible to trace any lines of chromatic material in the linin reticulum, which becomes more homogeneous and very faintly stainable as the resting stage is once more reached.

The formation of the cell wall between the two daughter nuclei takes place almost as soon as the chromosomes have become clustered together at the poles of the spindle. The exact method of wall formation could not be determined, but apparently granules are deposited in the region of the equatorial plate, and the membrane so formed extends outwards to the walls of the parent cell (figs. 20, 21). If the next cell division is to take place in the same direction, as is usual in root tips, the new cell wall is at right angles to the lateral walls of the parent cell. In some cases, however, one of the daughter cells is destined to divide in a plane perpendicular to that of the former division. Under these circumstances one daughter chromosome group, before its chromosomes have lost their identity, turns through a right angle, and then it becomes rounded off into a daughter nucleus (fig. 19). In such cases the cell wall is frequently formed in a diagonal position. This occurs rarely in roots, but very frequently in shoot tips where division occurs in all directions and the cells are irregular in shape.

DISCUSSION.

Since the present work deals only with the stages of somatic division, it is proposed to discuss only subjects which arise out of such work: for instance, the chromosome number, the nature of the chromatic bodies which appear in the nucleus in prophase, the development of the chromosomes, and the nature and behaviour of the nucleolus.

Anacyclus is a member of the *Anthemideæ*, and it has been found by Winge (*8*), and other workers, that nearly all plants in this group have a chromosome number of 9 or of a simple multiple of 9. This holds good in species of *Anthemis*, in many species of *Chrysanthemum* as described by Tahara (*5*, *6*) and Ishikawa (*1*), in *Matricaria*, and in *Tanacetum vulgare* as described by Rosenberg (*4*). The only exceptions to this series occur in *Achillea Millefolium*, which has twenty-four gametic chromosomes, and in *Centipeda orbicularis*, which has ten gametic chromosomes. In this investigation *Anacyclus* has been shown to have eighteen somatic chromosomes, a number in accordance with the series. It has, however, been noticed in anaphase stages that some of the chromosomes are lobed and that pieces of them could easily break off. This might account for an increased number, such as occurs in *Centipeda*, while we must admit at the same time that hybridization might have played a part in bringing about such divergences from the chromosome number series.

The chromatic granules which appear in the early prophase stages are very irregular in shape and number. They appear different under the action of different fixatives, since some fixatives seem to cause the precipitation of more chromatic material in staining than others. The fact that more of these bodies become visible at a later stage may be owing to their division, or to the fact that more of them take the stain. When they become arranged in parallel beaded threads it is evident that

EXPLANATION OF PLATE XVIII.

Fig. 13.—Lateral view of equatorial plate in cell of shoot tip at a stage following on fig. 10, showing characteristic constrictions in chromosomes. (Fw., Hh.)

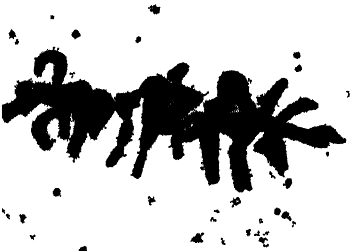
Fig. 14.—Lateral view of equatorial plate in cell of root tip at a stage later than fig. 12, showing split in chromosomes and free ends pointing towards the poles. (Fw., Hh.)

Fig. 15.—Stage similar to fig. 14 in cell of root tip, showing chromosomes drawn out still further. (Fw., Hh.)

Fig. 16.—Cell of root tip, showing separation of longitudinal halves of chromosomes. (H., Hh.)

Fig 17.—Cell of shoot tip at anaphase, showing daughter chromosomes opposite to one another. At this stage there is nearly always observed one chromosome on either side with a free end pulled out towards the pole. (Fw., Hh.)

Fig. 18.—Later anaphase in cell of root tip, showing chromosomes becoming thicker and more "woolly." (H., Hh.)



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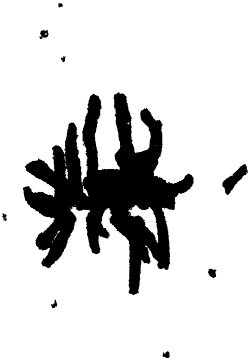

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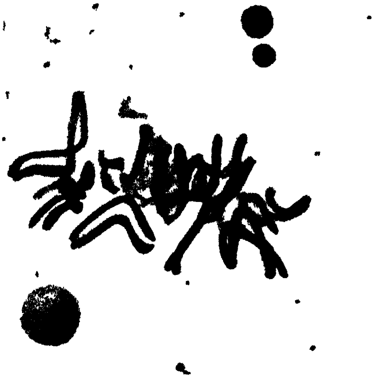

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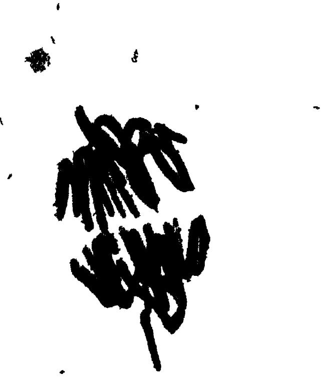

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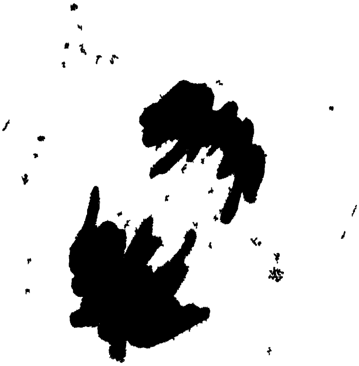

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they will give rise to the chromosomes. When the latter are first formed the separate granules are lost sight of, but later, in early metaphase stages, when the chromosomes are thin and their ends slightly split apart, they are seen to be beaded, the beads of the two halves of a chromosome corresponding with one another. These beads may therefore be derived from the chromatic granules of early prophase. When the daughter nuclei are being formed in telophase, the chromosomes become transformed into parallel beaded threads, like those in prophase, before completely losing their identity. Thus the granules are portions of entire chromosomes, which by becoming connected in linear series will constitute the chromosomes. In no case could any relationship be traced between the number of granules and that of chromosomes.

Although the individual chromosomes cannot be traced from one telophase to the following metaphase, it seems likely that they never change their relative positions in the resting nucleus. At both telophase and the next prophase stages they are arranged with their long ends towards the plane of the last division, and their curved portions, if they are bent, to the end wall of the parent cell. It seems very likely that they are never connected terminally with one another, but only by rather indefinite lateral connections. Throughout their visible history as beaded threads, or as a distinct spireme, they remain in this position. In the metaphase stage, when the chromosomes are arranged in one plane on the equatorial plate, their different sizes and shapes can be seen, and in anaphase their mode of insertion upon the spindle can be observed in a manner similar to that recorded by Litardière for *Crepis virens* (*3*). Thus in these stages, when they are seen as definite chromosomes that can be counted, their individuality can be easily traced. It is in the resting stage that they lose their staining properties, and it is at this time that the nucleolus becomes more noticeable in that it is deeply stained.

The true nature of the nucleolus is not clearly understood. It is evidently a variable body which, though usually spherical, can increase its surface by lobing or dividing into smaller globules. It may also become vacuolate. If several small nucleoli are present they seem to run together in just the same way as oil drops do. The crystalloid body which occurs in some nucleoli is not a new phenomenon, but has so far remained unexplained. It may be a centre around which the nucleolus is formed, but since it cannot always be demonstrated it is more probably of the nature of a secretion. In the prophase stages, the nucleolus stains less intensely as the chromatic bodies, and, later, the spireme threads become more and more deeply stained. Conversely, in telophase, the nucleolus stains more deeply as the chromosomes lose their identity and staining property. These changes have been interpreted in two ways. They may be due to the diffusion of some actual substance from the nucleolus to the thread and *vice versa*, or they may be explained as a reversible chemical change which shows itself in the variable staining capacity of nucleolus and thread. Miss Latter observed in work on the prophases of heterotype division in *Lathyrus* (2), that the spireme thread is always attached to the nucleolus, as though material were being transferred from the nucleolus to the thread. In the mitotic divisions of *Anacyclus* no such observation as this has been made, but the nucleolus here is not always central in position, sometimes being close to that side of the nucleus where the chromatic material is most dense. The behaviour of the nucleolus after the disorganization of the parent nucleus has not been observed, since by that time it has completely lost its staining properties. The faintly staining oily globules which occur in the cytoplasm may possibly be derived from it by fragmentation. It has never been seen to divide with the chromosomes on the equatorial plate, as figured by Tahara in the root tips of *Helianthus annuus* (5). When it is re-formed in the daughter nuclei it appears as several small globules, which as a rule ultimately make a single body, at that end of the nucleus at which the chromatic material is most dense, and here it increases in staining property, while the chromosomes become fainter and fainter in staining reaction. This again suggests some connection between the nucleolus and other chromatic bodies of the nucleus.

CONCLUSION.

Two points of special interest arise out of these observations: firstly, there is a parallel banding of the spireme during the prophase stages similar to that seen in telophase, and the

EXPLANATION OF PLATE XIX.

Fig. 19.—Telophase in cell of root tip, showing one daughter chromosome group revolving through a right angle in preparation for division in a direction perpendicular to that of the former division. (H., Hh.)

Fig. 20.—Telophase in cell of root tip following stage shown in fig. 18, showing lateral connections between chromosomes, the loops towards the pole still being evident. The beginning of cell-wall formation is also seen. (H., Hh.)

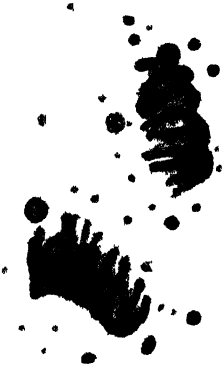
Fig. 21.—Cell of root tip, showing the chromosomes becoming rounded off into daughter nuclei, while the split is again visible. (Fs., Ft.)

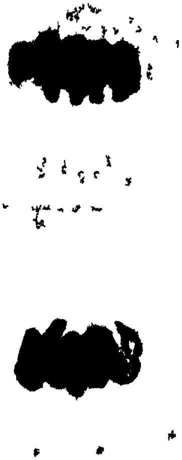
Fig. 22—Later stage in cell of root tip, showing loss of staining capacity by chromosomes, and the reappearance of the nucleolus in the form of faintly staining globules. (H., Hh.)

Fig. 23.—Later stage in root tip, showing the chromosomes again appearing as linear series of granules, and the fusion of the portions of nucleolus together, with an increase in its staining power. (H., Hh.)

Fig. 24.—Cell of root tip, showing one of the daughter nuclei having nearly reached the resting stage, but still showing chromatic granules. (H., Hh.)

The figures were drawn with a camera lucida, under a Zeiss 2 mm. oil-immersion lens, N.A. 1·25, ocular 18. The magnification is 3200×.





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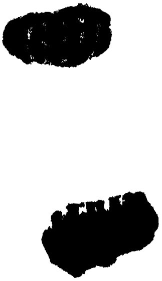

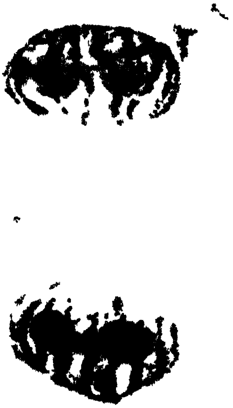

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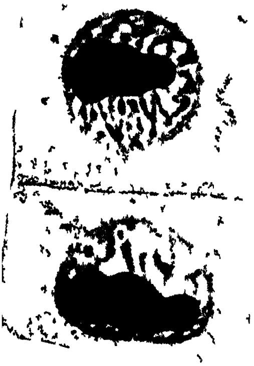

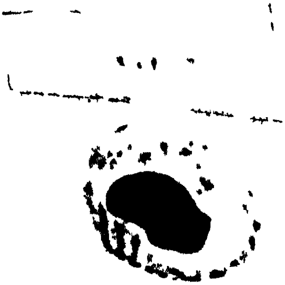

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following division always occurs at right angles to the direction of this banding; secondly, there is some evidence that when one daughter nucleus is to divide in a plane at right angles to that of the former division, it revolves through a right angle while in the telophase condition before it is rounded off as a new nucleus, so that the next division may also be at right angles to the direction of the banding, suggesting that the nuclear material never changes its position during the resting stage.

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XIV.—THE EFFECT OF FIXATIVE ON STAINING REACTION.

By EVELYN E. HEWER, D.Sc.(Lond.)

(Lecturer in Histology at the London (Royal Free Hospital) School of Medicine for Women).

(*Read June* 2, 1926.)

IN the routine examination of histological material the writer has been struck by the varying colours obtained with certain stains at different times, and it seemed possible that one cause of the variation might be the fixative used, quite apart from the well-known mordanting effect that some mixtures exert on certain stains.

METHOD.

Fresh material was obtained from animals that had been killed by a blow on the head, thus avoiding any possible effect due to an anæsthetic; small portions of the various organs were taken and immediately fixed in the solutions to be tested. The fixatives chosen for the investigation were :—

(*a*) Formo-acetic-Muller (5, 5, 90).
(*b*) 7 p.c. formol-saline.
(*c*) 7 p.c. formol-saline neutralized.
(*d*) Bouin's fluid.
(*e*) Formol-Müller neutralized.

The material was imbedded in wax in the usual way, and sections stained by the following methods :—

(*a*) Scott's hæmatoxylin and/or Biebrich scarlet.
(*b*) Giemsa's stain.
(*c*) Mallory's connective tissue stain.
(*d*) Mallory's connective tissue stain with fuchsin.

Stained sections were compared only with corresponding sections made from material that had been taken at the same time from the same animal. (The relative values of the fixatives as fixatives are not here considered.)

1. *Mucin.*—Sections of intestine, both small and large, and of salivary glands were used. The mucin was found to have different staining affinities in different localities, and the different colours obtained are due probably as much to the varying chemical nature of the mucin as to the varying fixative, and it is also possible that the mucin of any one organ may vary in composition at different times.

(*a*) Mallory's stain with fuchsin. The mucin always stains light blue, the colour being rather darker after formol.

(*b*) Mallory's stain without fuchsin. Again the mucin always stains blue, salivary mucin staining more intensely than alimentary mucin. After Bouin fixation the staining of all types of mucin is extremely bright.

(*c*) Giemsa's stain.

	Formo-acetic-Muller	Formol-saline	Formol-saline Neutral	Bouin
Salivary gland	Light blue	Pinky-mauve	Light blue	Pinky-mauve
Small intestine... ...	Light pink	Unstained	Unstained	Unstained
Large intestine ...	Mauve-red	Red-purple	Pink-mauve	Dark purple

(*d*) Hæmatoxylin and Biebrich scarlet. The series is incomplete, but after formo-acetic-Muller fixation salivary mucin stains bright blue, small intestine mucin dark red-purple, and large intestine mucin is not stained.

2. *Blood.*—Blood smears were not tried, but the staining of blood in sections of various organs was noted. The staining is constant for the blood of all organs except the thyroid and suprarenal medulla ; in the thyroid, colloid material is frequently mixed with the blood, and this somewhat obscures the staining ; in the suprarenal medulla the variations are due probably to admixture with adrenalin.

Stain	Formo-acetic-Muller	Fixative Formol-saline	Neutral Formol-saline	Bouin
Mallory + fuchsin ...	Yellow	Very deep crimson	Deep crimson	Magenta
Mallory − fuchsin ...	Yellow	Yellow	Yellow	Yellow
Giemsa	Green	Yellow-green	Green-yellow	Yellow-pink
Hæmatoxylin + Biebrich scarlet	Orange	Yellow	Yellow	—

The staining of blood with Orange-G is not affected by the fixative, but the erythrocytes show a most marked affinity for magenta (even in the presence of Orange-G) after formalin or Bouin fixation ; if $K_2Cr_2O_7$ is present the erythrocytes will not pick up the magenta.

3. *Nuclei.*—With Orange-G staining the fixative does not alter the staining reaction, the nuclei being always yellow ; if magenta is used in addition a more orange tinge is obtained as a rule, but

the colour varies in different organs—e.g. in the thymus and salivary glands it is always orange, but in the liver the real orange colour is only obtained after Bouin fixation, formalin imparting a bluish tinge and formo-acetic-Müller a pinkish tinge; this pinkish colour is also found in kidney nuclei after formo-acetic-Müller. With Giemsa staining the nuclei are always blue, but a purple tinge is found after formalin fixation (absent if the formalin is neutralized), and always in lymphocytes except after Bouin fixation.

It may perhaps be possible to correlate these variations with the pH of the various cells, as it has been shown that this varies in different organs.*

4. *Kidney Convoluted Tubules.*—With Giemsa staining the cells are always blue, or greenish-blue. With Mallory staining (with or without fuchsin), a remarkable differentiation is seen in the cells, the inner edge next to the lumen always staining bright blue, and the outer part of the cell yellow with the Orange-G, the colour being more orange if fuchsin is added. This differential staining is not well shown by other staining methods, and is not affected by the fixation; it is related probably to the secretory activity of these cells.

5. *Striated Border of the Alimentary Columnar Cells.*—The following staining reactions are given :—

Stain	Formo-acetic-Muller	Formol-saline	Neutral Formol-saline	Bouin
Mallory + fuchsin ...	Magenta-red	Purple-blue	Blue	Dark red-brown
Mallory − fuchsin ...	Yellow	Blue	Blue	Yellow
Giemsa	Pale blue	Pale green	Pale blue	Pale blue

Hence the staining affinity of this structure for Orange-G, magenta, and aniline-blue is most markedly affected by the fixative used.

6. *Pancreas.*—The pancreatic secretion has a high pH (8·3), and one would expect therefore that the affinity for stains might be affected by fixatives with varying pH, such as those in the series chosen. None of the fixatives used modified the staining of the islet cells. The staining of the alveolar cells with Giemsa's stain was not affected by the fixative, but with the Mallory mixtures these cells showed an affinity for fuchsin after Bouin fixation, and for Orange-G after the other fixatives.

The acidity of the fixative therefore does affect the staining reaction to a certain extent.

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* Mayr. Hofmeister's "Beitrage," vol. vii. Quoted in Lee's "Microtomist's Vade Mecum," 1921.

7. *Thyroid.*—The colloid is hardly stained at all with Biebrich scarlet if the fixative is neutral; if it is acid the colloid shows an affinity for this stain especially after formo-acetic-Müller. Using Mallory's stain the fixation seems to have little effect. In a further and wider series, using formo-acetic-Müller or formol fixation, the colloid was found to show very varying staining affinities for such dyes as hæmatoxylin, resorcin-fuchsin, and aniline-blue-Orange-G quite independently of the fixative used; and further, whatever the fixative and whatever the stain used, it is exceptional to find uniform staining throughout all the vesicles. Chemical variation in the colloid itself is the most probable cause of this variation in staining, a point which is now being investigated.

8. *Cytoplasm, in General.*—The fixation does not affect the staining of the cytoplasm with Giemsa's stain, nor with Mallory's stain, the colour being pale green-blue in the former and yellow in the latter case. If, however, fuchsin is added to the Mallory staining, the cytoplasm stains orange after all the fixatives used except formo-acetic-Muller, when the colour is almost magenta.

9. *Oxyntic Cells, Muscle and Collagen.*—The staining of these substances by the methods tried is not affected by the fixation. The oxyntic cells have little affinity for these particular stains (except Biebrich scarlet), but they are well contrasted with the peptic cells by Giemsa's method, as the latter stain very dark blue and the oxyntic cells are very pale.

SUMMARY.

In general, fixation with ordinary formol-saline is followed by sharper and brighter staining reactions than when the formol is first neutralized.

Bouin fixation diminishes the sharpness of the colour differentiation when using Mallory + fuchsin staining; neutralizing the formol makes the general colour reactions obtained less blue and purple with this stain than when the formol is used unneutralized, and after formo-acetic-Müller the blue shades become purple.

The most striking effects of fixative on staining reaction were found in the case of blood, of the striated border of the alimentary columnar epithelium, of the nuclei in certain organs, and of thyroid colloid. The staining reaction of nuclei varies in different organs, as does also the affinity of mucin for stains. With respect to the thyroid colloid, the staining reactions vary greatly, and it appears probable that the actual chemical composition of the colloid plays here as important a part as the fixative used.

It is seen therefore that the choice of fixative will in some cases greatly affect the colour obtained with certain stains, irrespective of any mordant action.

XV.—THE WILSON MICROSCOPES.

By R. S. Clay, B.A., D.Sc., F.R.M.S., and Thomas H. Court.

(*Read February* 24, 1926.)

One Text-Figure.

Perhaps the most successful of all early single microscopes as regards convenience, performance, and the extent to which it was made and used, was the screw-barrel microscope associated with the name of Wilson.

Though certainly not the inventor of this form of microscope, Wilson so improved its optical performance, that its popularity and commercial success were undoubtedly due to his work.

The originator of the screw-barrel microscope was the Italian Tortona, who described his microscope at a meeting of the Physics Mathematical Roman Academy held in the house of Lord Campini on Aug. 5th, 1685. The tube was 2 inches long and 2 scruples radius. It was composed of five parts, each joined by a screw to the succeeding part, and it could be divided into a microscope and an eye-glass. Tortona refused at the time to show its internal construction, but said that it contained five lenses, of which one was a non-spherical one. It was used to show the circulation of the blood. An account appears in " Acta Eruditorum," 1685, p. 478; also in "Campini Nuove Inventioni di tubi ottici," 1686; and yet another in "Miscellanea Curiosa,' 1689, Norimberg, p. 444, where it is illustrated (fig. 39). It is there said that it was 4 inches long.

In 1689 Joseph Campani and Marius Antonius Celi exhibited similar microscopes to the same Academy (fig. 41). In all these the focussing was effected by screwing the body of the microscope in and out of a ring, usually brass, to which the stage was fastened by three rods or similar connecting links. Also the instrument was intended to be used in the hand and held up to the sky, so that the light might pass through the (transparent) object. The body of the microscope was stated to be of wood. In all of them one or more illuminating lenses could be inserted in a wooden cell below the stage. In one case these illuminating lenses are shown as a pair of plano-convex lenses with the curved surfaces turned towards each other and practically touching one another. Nothing is said of their magnifying power. All these microscopes were *compound* ones, but no optical details are given, though a diagram (admittedly guesswork) in the "Miscellanea Curiosa" shows an objective, a field lens and an eye-glass, all double convex. Two microscopes of this type and of about this date were included in the Crisp sale. One, engraved "Campani," was bought by the South Kensington Science Museum, and Mr. Court secured the other, which though not engraved is most probably by the same maker and may be the earlier of the two.

The lenses made by Campani were well ground, and he consequently acquired great reputation as a telescope and microscope maker. But about this time a great many were using fused beads as objectives. The fused bead was first made by Torricelli of Florence.

Tortona's microscope was also copied very closely by Bonanni ("Micrographia Curiosa," 1691, p. 26). Bonanni, however, made an important addition in the pair of brass plates between which the slider of objects was to be put; one of these was fixed and the other pressed down towards it by a helical wire spring.

All these microscopes of Tortona, Campani and Bonanni were as above stated compound microscopes. It was Nicolas Hartsoeker who first applied this design to the single microscope. His microscope is shown in his "Essay de Dioptrique," 1694, p. 175, where all the essential features of the screw-barrel microscope are included. Indeed in his microscope the condenser lens was carried in an additional focussing screw barrel, whereas in the later instruments this lens was held permanently at the end of the microscope barrel.

Wilson has often been charged with plagiarizing Hartsoeker's microscope, and even Mayall in his "Cantor Lectures," 1885, p. 32, refers to Hartsoeker's "anticipation of Wilson's instrument in every essential point of design." A careful reading of the Preface to Wilson's original account (*vide infra*) of his microscopes shows however that he makes no claim to originality.

There are fortunately at least two Wilson microscopes in existence with his signature, and we can, therefore, still see for ourselves the position which the single microscope had attained both optically and mechanically at the beginning of the 18th Century.

James Wilson was in business "At the Willow Tree in Cross Street, Hatton Garden." "He makes all sorts of Dioptric and Catopric Glasses and Tellescopes (*sic*), Prospects, Camera Obscuras, Magic Lanterns and Selleth the best of Spectacles and Reading Glasses," etc. His sign is of interest as other opticians usually adopted a sign which bore some reference to optics, such as "Golden Spectacles," "Golden Prospect Glasses," Globes and Quadrants, Astrolobe, "Newton's Head," etc.

The date of Wilson's death is not known, but from the rarity of his microscopes and telescopes he probably died very early in the 18th Century.

Wilson has given three accounts of his microscopes which show progressive improvements. The first was in the "Phil. Trans." for 1702, No. 281, under the title "The Description and Manners of Using a Late Invented Set of Pocket Microscopes made by James Wilson," and the Preface to his pamphlet runs: "The late Improvements made by Magnifying Glasses are not so much owing to the making them and composing Microscopes, as the Methods of applying objects for the advantage of Light; in which I hope the Instruments before us will not be found inferior to any yet made, at least commonly Sold. . . ."

In this account he shows two independent instruments, a compass microscope and a screw-barrel one. The powers only are common to the two. The screw barrel was of ivory. The two brass plates, between which the slider containing the objects was placed, were held between a cork pad and a brass wire spring. There was an illuminating lens in the end cell. The objectives all screwed into the other end. The compass microscope was entirely of brass, and provided with a spike. The objective, which had a hole in the side, was attached to this spike and held in position by a spring. It is worthy of note that this method of attaching the magnifying object lens to a compass one by fixing it to a spike was the usual method on the continent of Europe, and perhaps in England, e.g. at this time the microscopes (single compass) of Musschenbroek and Cuno both had this form of attachment. There were eight objectives common to the two instruments, and a ninth of lower power for the compass microscope only.

There is a letter from one Sir C. H. to the publishers in the "Phil. Trans.," Aug. 11, 1703, No. 284, in which the writer says he has compared Mellen's (*circa* 1680) microscope and considers Wilson's microscope to go far beyond any of Mellen's, although not so neatly set. The greater magnifier especially augments more and it shows an object more distinctly than his. He further states that he intends to fix Wilson's microscope to an arm to slide up and down on "the square rod" of his deep microscope (no doubt a Marshall) to be set by a screw to any settled position which will be necessary when "an illuminating glass is added"—probably referring to a mirror.*

The second account was published by Wilson in a six-page pamphlet dated 1706, with a plate showing the instruments. In this the words "late invented" are omitted, otherwise the wording is the same as in the first pamphlet. In this second form he had embodied several improvements.

1. He supplied a turned brass handle which could either be screwed to the outer framework of the screw-barrel microscope, or

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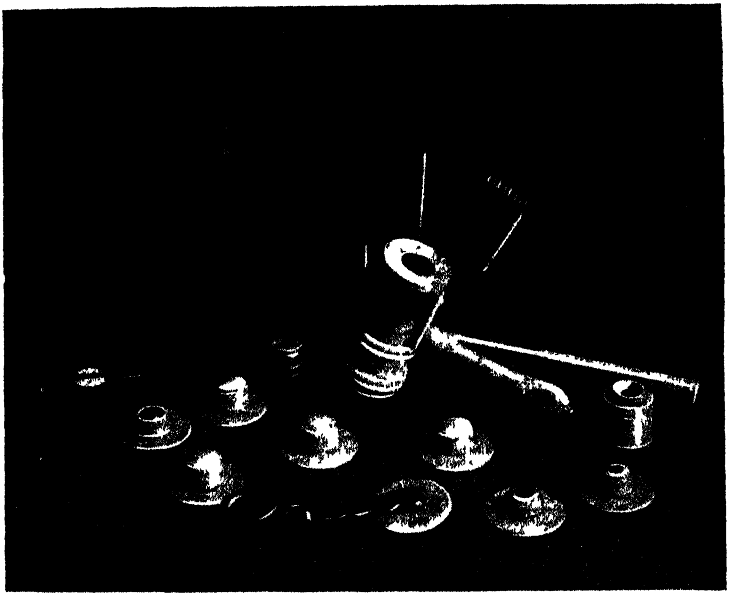
* (In the Court collection there is an early brass Wilson microscope without handle which has a screw thread at the end where the condensing lens is—no doubt to fit it to some such support).

be attached to the compass microscope, and the latter was much better made.

2. The spiral spring was of steel wire in place of the brass wire of the original.

3. The compass microscope had a ring into which the powers screwed (in place of the spike), and consequently the powers had no small hole provided for attachment to the spike.

4. The pad between the end of the screw barrel and the stage plates was of leather instead of cork, no doubt because of the bad wearing quality of cork A fine and complete example of this form is contained in the Orrery Collection at Oxford.



Example of the third type, from the "George III. Collection," sold at the Crisp Sale, in the possession of Mr. Court. It is signed I. W.

This pamphlet is practically reproduced in Harris, "Lexicon Technicum," vol. 11, 1710, including the plate.

Smith, in his "Optics," 1738, Vol. 11, p. 398, plate 58, fig. 647, figures and describes Wilson's microscope. He states that his account is taken from the "Phil. Trans.," but this is not so; he has probably copied Harris, whose account is from the 1706 pamphlet, and this instrument is not exactly the same as described in 1702 to the Royal Society. Smith's description with its errors has been copied in nearly all Encylopædias and Science Dictionaries right down to the middle of last century—an instance of the way an initial error is perpetuated by those who rely on other writers instead of referring to original sources.

The third account is contained in a pamphlet, of which Mr. Court also has a copy, on which is written "Richard Oliver 1711," also a list of "objects to be placed between the muscovy glasses to be seen by the glasses 1. 2. 3. 4.", and other writing by the same hand, thus proving that it must have been issued between 1706 and 1711. In printing this second pamphlet Wilson has used the original letterpress (which is thus still dated 1706) and the original copper-plate; but he has rubbed out one of the illustrations on the plate and substituted the picture of the opaque holder. He has also added a fly-leaf of reading matter explaining the new improvement. This fly-leaf is missing from the copy in the British Museum, and in its absence the account does not tally with the figure. The handle is of ivory and has a male screw as contrasted with the female screw of the second type.

Wilson also provided a circular plate which screws into the end of the case of the screw barrel in place of the objective, and which carries a ring into which the objective itself screws. The stem of the spring forceps is passed through a hole in the leather, and both transparent and opaque objects can be held in them. Thus the compass microscope was no longer necessary, and could be omitted.

We have thus shown how Wilson introduced this popular form into England in 1702, improved it in 1706, and still again between 1706 and 1711, and left it in all essential details in the form in which it remained for at least 100 years. The hole in the leather for the stage forceps was not satisfactory, and led to the introduction of the forceps plate, probably by Culpeper about 1720; at a later date the hole for the forceps was restored, but now in a brass plate at its junction with the screw barrel, thus reverting to Wilson's original form. It was made in this form by Cuff, Mann and Ayscough, Adams, Nairne and others; Culpeper and Scarlet, Cuff and other makers added a compound body which screwed to the case at the objective end. Each of the two first-named also added a stand, Culpeper's having a flat folding foot, and Scarlet's a tripod like that of a telescope. Another modification was the substitution of a rack-and-pinion to move the barrel in its case in place of the long screw on its surface.

SUMMARY OF CURRENT RESEARCHES
RELATING TO
ZOOLOGY AND BOTANY
(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),
MICROSCOPY, Etc.*

ZOOLOGY.

(*Under the direction of* Dr C. Da Fano.)

CYTOLOGY IN GENERAL.

Elasticity as an Indicator of Protoplasmic Structure.—W. Seifriz (*Amer. Nat.*, 1926, **60**, 124–32). Protoplasm should be regarded as essentially a protein-like substance, fibrous in structure, which is permeated by an emulsion of food constituents. This emulsion, in an ultramicroscopic state, may play a prominent part in some physiological processes, but those physical properties which so fundamentally characterize protoplasm, such as elasticity, rigidity and imbibition, can exist only in virtue of the fibrous structure of protoplasm, no matter whether made up of either homogeneously distributed chain-molecules or of an entangled mass of intertwining crystalline fibres, the ultramicroscopic emulsion being situated in the intermolecular spaces if the structural units are molecules and in the intermicellar space if the units are colloidal. C. D. F.

The Golgi Apparatus.—R. H. Bowen ("The Golgi Apparatus—its Structure and Functional Significance," *Anat. Rec.*, 1926, **32**, 151–93, 2 text-figs.). This paper is devoted to a critical review of the more recent research work on the Golgi apparatus. The author expresses the opinion that the Golgi apparatus is the synthetic centre of the cell wherein are built up primarily those cellular products which in the broadest sense of the term may be classified as secretions, including, therefore, some things which ordinarily pass under the name of excretions. R. J. L.

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* The Society does not hold itself responsible for the views of the authors of the papers abstracted. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, etc., which are either new or have not been previously described in this country.

A. VERTEBRATA.

a. Embryology, Evolution, Heredity, Reproduction, and Allied Subjects.

Origin of the Germ-Cells of the Fowl.—J. H. WOODGER ("Observations on the Origin of the Germ-Cells of the Fowl (*Gallus domesticus*), studied by means of their Golgi bodies," *Quart. J. Microsc. Sci.*, 1925, **69**, 445–62, 10 text-figs.). The primitive germ-cells of the genital ridge are continuous with those of the splanchnic mesoderm of earlier stages and with the large cells of the blood stream of earlier ones. They are easily distinguished by their size, pseudopodia, yolk-content and Golgi bodies, both from the blood-cells and, when lying in the mesenchyme, from other cells which surround them. About their continuity with the cells separated from the germ-wall endoderm in front of the primitive streak, the author feels less able to speak, because at this stage the Golgi bodies have not given the help he hoped they would in the identification and separation of these cells. Dantschakoff has, however, shown that the conspicuous cells of the blood stream arise independently of the blood-islands from the germ-wall endoderm.
C. D. F.

Connective-tissue Ground-Substance.—G. A. BAITSELL ("On the Origin of the Connective-tissue Ground-Substance in the Chick Embryo," *Quart. J. Microsc. Sci.*, 1925, **69**, 571–89, 4 pls.). In the chick the forerunner of connective-tissues is a transparent cell-free ground-substance which pervades the embryonic body from very early stages of development, and is formed as a secretion of the cells of the germ-layers. In the early stages this ground-substance is, for the most part, homogeneous. Subsequently it becomes fibrillar, the fibrils being due to changes in the ground-substance, and not to a transformation of cytoplasm. The formation of the ground-substance is followed by the invasion of the mesenchyme cells which, using it as a supporting material (as cells do in tissue cultures), move through and modify it in various ways.
C. D. F.

Sterility in the Albino Rat.—K. E. MASON ("A Histological Study of Sterility in the Albino Rat due to a Dietary Deficiency," *Proc. Nat. Acad. Sci., U.S.A.*, 1925, **11**, 377–82.). Degeneration in the testes resulting from dietary deficiencies may be divided into five stages. (1) The mature spermatozoa lose their individuality and clump together to form irregular blotches of chromatin material. Other stages in spermatogenesis are normal. (2) The spermatozoa have disappeared and the spermatids are undergoing disintegration. The spermatocytes and spermatogonia are normal. (3) Giant cells are formed from masses of the degenerate spermatids, the rest of which pass into the epididymis. The giant cells subsequently become pycnotic and liquefy, and by this time degenerative processes have started in the spermatocytes. (4) The processes going on in stage (3) continue, with all the spermatogenic elements involved. (5) This stage shows a condition analogous to the cryptorchid testis. The germinal epithelium is reduced to a syncytium of Sertoli cells; these and the interstitial cells are never found to be affected. C. S. P.

β. Cytology and Histology.

Jolly Bodies in Human Erythroblasts.—W. KNOLL ("Jollykörper in menschlichen Erythroblasten phylogenetish betrachtet," *Hæmatologica*, 1925, **6**, 81–93, 2 pls.). Jolly bodies occur in embryonic erythroblasts with perfectly preserved nucleus; they cannot, therefore, be a product of the chromatinolysis of the nucleus as generally admitted. In addition certain methods of staining show that they consist of a material which differs in some respects from nuclear chromatin. and that they are probably connected with the production of hæmoglobin. C. D. F.

The Giant-Cells of the Bone Marrow.—G. DI GUGLIELMO ("Sul sistema delle cellule giganti midollari," *Hæmatologica*. 1925, **6**, 156–95, 2 pls.). All giant marrow cells arise from primary histioid and basiphil mononuclears or pre-polykaryocytes. By cytoplasmic fusion these give rise to multinucleated giant-cells or polykaryocytes which by nuclear fusion and gemmation become in their turn transformed into more or less ripe giant-cells or megakaryocytes. C. D. F.

Polykaryocytes and Megakaryocytes.—S. GANDOLFO ("Policariociti e megacariociti negli organi embrionali di nammiferi e nelle anemie sperimentali," *Hæmatologica*, 1925, **6**, 244–58). Polykaryocytes are only juvenile or immature forms of megakaryocyte, and in certain phases of their evolution they are characterized by the presence of cytoplasmic azurophil granules. Polykaryocytes cannot be identified with osteoclasts which have, in addition, a quite different function. Polykaryocytes and megakaryocytes increase considerably in number in experimental anæmias and during pregnancy. C. D. F.

Shape of Erythrocytes.—G. MIRONE ("Di un particolare morfologico dell' emazia dimostrabile coll' inchiostro di china," *Hæmatologica*, 1925, **6**, 26–8, 1 fig.). By mixing a small drop of human blood with one of indian ink on a coverslip and inverting this very gently on a slide, one can easily see in the microscope that the erythrocytes are cup-shaped and not biconcave. This agrees with the results of previous observations of Weidenreich and Marassini on the blood of man and other mammals. C. D. F.

Histioid Cells in Circulation.—L. FONTANA ("Contributo allo studio delle cellule istioidi circolanti in varie emopatie," *Hæmatologica*, 1926, **7**, 97–136, 3 pls.). The author has used cases of leukæmia in an attempt to solve the problem of the structural characters of the parent form of the blood cells. He states that they have many of the characters of tissue cells, but may contain neutrophilic, eosinophilic or basophilic granules. These cells do not seem to be identical with the myeloblast (the parent form of the granular leucocytes) because they occur in the blood even in association with increases of lymphocytes; it seems, therefore, that they are true stem-cells. A. P.

Azurophil and Eosinophil Inclusions in Leucocytes.—A. HITTMAIR and R. RITTMANN ("Über azuro-, eosinophile Leukozyteneinlagerungen. Ein Beitrag zur Kenntnis des Akuten Myelose mit Zelleinschlüssen," *Hæmatologica*, 1926, **7**, 149–87, 3 pls.). The writers contend that the azurophilic inclusions which may be found in myeloblasts, hæmohistioblasts and lymphocytes are all of similar origin, viz. altered archoplasmic structures. They are also of opinion that neutrophilic granulation, the Auer bodies seen in some myeloblasts and the Kurloff bodies of the leucocytes of the guinea-pig are of similar origin. A. P.

Golgi Body in Erythrocytes.—D. R. BHATTACHARYA and F. W. R. BRAMBELL ("Erythrocytes of the Sauropsida," *Quart. J. Microsc. Sci.*, 1925, **69**, 357–9, 1 pl.). Investigations were carried out by Da Fano's cobalt-silver-nitrate method on the ovary of *Trionyx hurum*, *Testudo græca*, *Uromastix hardwicki* and *Gallus bankiva* The Golgi apparatus in the erythrocytes of these forms consists of one to several small bodies which are densely impregnated with the silver. Their position in the cytoplasm varies in different cells ; they are more frequently to be seen close around or even plastered on to the nucleus, but in some cases one or more of the bodies may be situated between the nucleus and the periphery of the cell, yet in other cases one has been observed to occupy a peripheral position. C. D. F.

Golgi Bodies in Neurones. - A. SUBBA RAU and R. J. LUDFORD ("Variations in the Form of the Golgi Bodies during the Development of Neurones," *Quart. J. Microsc. Sci.*, 1925, **69**, 509–17, 1 pl.). In the spinal ganglia of the chick of four days the Golgi apparatus is in the form of a cluster of granules or rodlets, grouped around the centrosphere, at one side of the nucleus. Subsequently it spreads farther around the nucleus and finally throughout the cell. It is uncertain to what extent variations in the form of the apparatus, whether reticulate or in the form of individual rodlets, are due to differences in the degree of impregnation with silver. The plane of the section is also an important factor in determining the appearance presented by the apparatus. The medullary cells of the suprarenal body have the apparatus in the form of a coiled network or cluster of granules at one pole of the nucleus, similar to the cells of the spinal ganglia at the early stage of development. C. D. F.

Cell Organs during Secretion in the Epididymis.—R. J. LUDFORD (*London, Proc. R. Soc.* (B), 1925, **98**, 354–72, 28 text-figs.). The epithelium of the epididymis of the mouse was principally studied. During secretory activity the Golgi apparatus hypertrophies and assumes different forms according to the degree of secretory activity. The secretory products make their appearance in intimate relationship with the apparatus and are of three types: droplets, granules and complex granules probably consisting of a solid core and a fluid periphery. In osmic-fixed material the nucleus contains a single oxyphil nucleolus. During secretion part of it becomes basophil, increases in size and breaks up into fragments which are extruded into the cytoplasm. The mitochondria increase in number at the onset of secretory activity and decrease during its course. They are often found in immediate contact with the formed secretion. The secretory activity is maintained by (1) elimination of vast products of metabolic activity, (2) reconstruction of the Golgi apparatus, mitochondrial content and nuclear chromatin, and (3) replacement of worn-out cells chiefly by basal cells. C. D. F.

Enamel in Mammals.—G. JASSWOIN ("On the Structure and Development of the Enamel in Mammals," *Quart. J. Microsc. Sci.*, 1925, **69**, 97–118, 2 text-figs., 1 pl.). The enamel consists of enamel fibres (prisms) and ground (interprismatic) substance. The prisms have a cylindrical shape and no side projections; they originate through the impregnation of the endoplasmic extensions of the inner epithelial cells (Thomes's processes of the ameloblasts) with the secretory product of the latter. The ground-substance arises from a transformation of the ectoplasmic substance produced partly by the inner epithelial cells previously to their differentiation into fully developed ameloblasts, and partly by the cells of the stratum intermedium. The histogenesis of the enamel is thus analogous to that of the dentine, the ground-substance being elaborated not by the fully developed ameloblasts or odontoblasts, but by the less differentiated cells of the intermediate layer and of Weil respectively. Both ameloblasts and odontoblasts pass through the stage of narrow intensely staining cells in their development; their ectoplasm begins to change into ground substance in the case of the former while still in the enamel pulp, and in that of the latter while in the region of the dental papilla. The stable union of enamel and dentine is effected through the junction of their ground-substance. The cells of the enamel organ are provided with Golgi apparatus which in the initial stages of their differentiation is situated above the outer pole of the nucleus; subsequently, in accordance with the changed functional polarity of the cells, it gradually moves to the inner pole of the nucleus. The migration is almost concluded at the stage of origin of Thomes's processes and the formation in the endoplasm of the ameloblasts of secretory granules which appears in the area occupied by the apparatus. C. D. F.

Participation of Golgi's Apparatus to Histogenetic Processes.—S. TIMOFEJEV ("Der Anteil des Golgischen Binnennetzes an histogenetischen Prozessen," *Arch. Russes anat. hist. embr.*, 1925–6, **4**, 73–82 and 165–6, 1 pl.). In the ameloblasts and in general in the cells of the enamel organ of new-born kittens and puppies the Golgi apparatus is situated next to the distal (external) pole of the nucleus. When enamel begins to form the apparatus of the ameloblasts considerably hypertrophies and both the nucleus and the apparatus are shifted from the previous position; the nucleus moves towards the distal portion of the cell, while the apparatus moves in the opposite direction and finally becomes situated next to the proximal (internal) pole of the nucleus, reaching occasionally the inner ameloblastic membrane. In the cells of the enamel organ, which do not produce enamel, no such reversal in the polarity of the Golgi apparatus is observed. These observations agree with the previous ones of Jasswoin. C. D. F.

Cell Organs during Keratinization.—R. J. LUDFORD ("Cell Organs during Keratinization in Normal and Malignant Growth," *Quart. J. Microsc. Sci.*, 1925, **69**, 27–57, 9 text-figs., 3 pls.). Observations were confined to small laboratory animals, chiefly mice and rats. Keratinization was studied in normal epidermal cells, cases of hypertrophy of the epidermis and tumours of experimental and spontaneous origin. Both under normal and pathological conditions the first indication of impending keratinization is the dispersal of the Golgi apparatus and mitochondria unless these are already scattered throughout the cytoplasm as in certain malignant growths. During keratinization most mitochondria apparently disappear and only some become perhaps transformed into keratohyalin granules. After dispersal throughout the cytoplasm the Golgi apparatus is no longer stained by osmic acid, but, as shown by Da Fano and others, its fragments are still impregnated by silver nitrate until an advanced stage of keratinization. After these changes the nucleolus generally breaks up and its fragments are extruded into the cytoplasm where they seem to contribute to the formation of keratohyalin granules. C. D. F.

Golgi's Apparatus of Gland-Cells.—R. H. BOWEN ("Studies on the Golgi Apparatus in Gland-Cells. I. Glands associated with the Alimentary Tract," *Quart. J. Microsc. Sci.*, 1926, **70**, 75–112, 6 pls.). In all gland-cells examined a close topographical relation was found to exist between the Golgi apparatus and developing secretory granules. Both in serous and mucous gland-cells the apparatus hypertrophies in the early stages of the secretory cycle, but, while in serous cells it tends to spread through the mass of developing granules, it remains more compact and peripherally situated in mucous cells. This is apparently correlated with the fact that in mucous cells the secretory granules are completed very soon after their formation, while in serous cells the whole content of granules progresses gradually towards simultaneous completion. Topographical and structural differences in the Golgi apparatus show that the Gianuzzi crescents are probably serous cells, and that the cells of the pulmonate salivary gland are of two types, mucous and serous, between which, at least in their active stages, no interchangeable relations exist. J. R. L.

The Glycogenic Body of Birds.—O. OLIVO ("Di alcuni caratteri fisici e chimici del corpo glicogenico del midollo lombo-sacrale degli uccelli," *Boll. Soc. biol. sper.*, 1926, **1**, 81–4). The cells forming the gelatinous substance (glycogenic body) of the lumbo-sacral region of the spinal cord of birds are similar to vesicles filled with a concentrated solution of glycogen. The cytoplasm is concentrated into a small mass next to the nucleus and forms the very thin wall of each vesicle. This wall is impermeable to glycogen but permeable to crystalloids. It has not, as yet, been possible to ascertain whether the glycogen exists within the vesicles in a pure state or in combination with proteins. C. D. F.

Nerve-endings in the Cloaca of the Frog.—E. C. COLE ("Intramuscular Nerve-endings of a receptive Type in the Cloaca of the Frog," *J. Comp. Neurol.*, 1925, **38**, 369–73, 1 text-fig.). Observations on the wall of the cloaca of *Rana pipiens* stained intra vitam with methylen-blue. A medullated fibre, emerging from the myenteric plexus, is seen to sink into the circular muscle layer, make several abrupt turns and give rise to a complicated aborization. Its fibrils are very thin, usually lightly stained and provided with relatively large and often heavily stained varicosities. In some cases the main fibre passes on to another region where it forms another arborization. Measurements show that such an ending lies adjacent to a large number of smooth muscle cells —an ideal situation for stimulation by contraction or distension of the circular muscle coat. C. D. F.

Structure of the Myenteric Plexus.—S. E. JOHNSON ("Experimental Degeneration of the Extrinsic Nerves of the Small Intestine in relation to the Structure of the Myenteric Plexus," *J. Comp. Neurol*, 1925, **38**, 299–314, 9 figs). According to the author the structure and relations of the myenteric plexus are similar to those of all other sympathetic ganglia. In the myenteric plexus of the cat and dog only one type of nerve-cells occurs and no evidence of true nerve-nets and synapses between local elements is available. The association between extrinsic and intrinsic elements takes place by means of the usual type of intercellular plexus while the extrinsic fibres, which enter the gut wall and form part of the intercellular plexus, arise from the vagus. The vagal neuron thus represents the preganglionic link, whereas the postganglionic links are the local neurons, the cell-bodies of which compose the myenteric ganglia. The cell-bodies of the postganglionic neurons associated with the splanchnic nerves are situated in the coeliac or other extra-intestinal sympathetic ganglia. C. D. F.

The Transverse Septa of the Heart-muscle.—E. FERNANDEZ-GALIANO ("Sobre la estructura y la significación funcional de la piezas intercalares del corazón," *Bol. Soc. Esp. hist. nat. Madrid.*, 1926, **26**, 227–46, 10 text-figs.). The investigation of the heart-muscle of mammals by reduced silver methods confirms the view that the transverse septa are bridged across by fibrils continued from one into another muscle fibre. Histologically therefore, the heart-muscle can be considered as a syncytium. Physiologically the septa with their bridging fibrils should be regarded as a mechanism confining each contraction to a certain number of muscle fibres. There is no contradiction between this supposition and the "all or none" law.

C. D. F.

Anastomosing Nerve-cells.—E. C. COLE ("Anastomosing Cells in the Myenteric Plexus of the Frog," *J. Comp. Neurol.*, 1925, **38**, 375–87, 10 figs.). The observation of binucleate nerve-cells in the myenteric plexus of the frog without any evidence of cell division, direct or indirect, led the author to assume that they were due to the more or less complete fusion of two adjacent nerve-cells. Nerve-cells connected by broad protoplasmic bridges were also observed in the same situation, and evidence is brought forward supporting the view that binucleate nerve-cells and anastomosing nerve-cells belong to the same category. The nervous nature of these cells is established by the presence of

Nissl's substance, a hyaline zone round the nucleus, a typical form, and the more or less varicose aspect of the axons. Other groups of anastomosing cells distinctly different from nerve-cells were found distributed through all the layers of the wall of the digestive tube. However these appear to be connective-tissue elements. C. D. F.

Palatal Taste-buds.—C. J. Herrick ("The Innervation of Palatal Taste-Buds and Teeth of Amblystoma," *J. Comp. Neurol.*, 1925, **38**, 389–97, 4 figs.). The fortunate impregnation by Golgi's method of some larvæ (approaching the metamorphosis) of *Amblystoma tigrinum* revealed the following details worthy of record: The palatal teeth contain nerve-endings similar to those described by Retzius. They are probably terminal aborizations of fibres derived by anastomosis from the trigeminus. The palatal taste-buds are encircled by dense spirals of nerve-fibres derived from the palatal plexus. The cell-bodies from which these fibres arise were not seen in the preparations. C. D. F.

γ. General.

The Chromosomes of Four Species of Marsupials.—S. C. A. Altman and M. E. W. Ellery (*Quart. J. Microsc. Sci.*, 1925, **69**, 463–9, 2 pls.). The number of chromosomes including XY in both male and female of *Potorous tridactylus* is 12; of *Phascolomys mitchelli*, 14; of *Trichosurus vulpecula*, 20; of *Pseudochirus peregrinus*, 20. C. D. F.

Xenopleura vivipara, g. et sp. n. (Enteropneusta).—J. D. F. Gilchrist (*Quart. J. Microsc. Sci.*, 1925, **69**, 555–70, 2 pls.).

Xenopleura, g. n.: Medullary folds extending posteriorly into low pleuræ and continued behind the first gill opening as oblique ridges across the sides of the body, fusing on the ventral aspect and continued for a short distance free from the body. "Stomochord" continued beyond the bifurcation of skeletal element and appearing as a definite group of vacuolated cells with a lumen which opens into the œsophagus behind the posterior neuropore. There it ceases centrally, but is continued on each side as two parachords lying in an involution of the enteric epithelium, external to the gills. The central part appears again a short distance posteriorly as a shallow groove of vacuolated cells and is continued backwards between the gills as the epibranchial ridge. One proboscis pore, no synapticula, last gill-sacs in the form of epithelio-enteric openings. No nerve roots. Pericardium simple.

X. vivipara, sp. n.: Comparatively small; eggs large, red. Two excretory tubes, one of which is smaller than the other and passes over it to join the opposite side, both opening to the exterior by one common pore. No external liver-sacs. C. D. F.

Regeneration in the Spinal Cord.—D. Hooker ("Studies on Regeneration in the Spinal Cord. III. Re-establishment of Anatomical and Physiological Continuity after Transection in Frog Tadpoles," *J. Comp. Neurol.*, 1925, **38**, 315–45, 2 text-figs., 1 pl.). The form and structure of the spinal cord may be restored after transection at any embryonic or larval age When the wound surfaces are not opposed, a portion of cord is regenerated between the two cut ends. Prior to regeneration, the distal portion of the cut neuraxes degenerates and the structures outside the cord (skin, notochord) undergo repair. The new piece of spinal cord is formed by: (*a*) The outgrowth. from both cut ends of the cord, of the axons of neurons situated in the original cord. These axons eventually enter the opposite wound surface to establish primary nervous continuity. (*b*) The elongation of the ependymal canal from each portion of the cord until fusion, and re-establishment of a central canal. (*c*) The proliferation of indifferent cells in the original cord, their migration into the bundle of neuraxes connecting the cut ends of the cord and their differentiation into neuroblasts and spongioblasts which restore the structure of the new cord. The physiological continuity of the transected cord may be restored following the establishment of its primary nervous continuity, but complete restoration of function occurs only after more or less complete form restitution of the cord. C. D. F.

Changes of Nerve-fibres due to Anæsthetics.—N. GAVRILESCU ("Modificazioni causate nelle fibre nervose degli anestetici," *Arch. sci. biol.*, 1926, **8**, 203–8, 8 figs.). Microscopical investigations by polarized light. The author confirms the observations of Marinescu, Lapique and Legendre regarding the changes of nerve-fibres dissociated in Ringer's solutions, and then placed in contact with anæsthetics such as ether and chloroform. The main change is characterized by a swelling of the myelin which is not due to injuries consequent upon dissociation.
C. D. F.

Tissue Cultures of the Spleen.—I. FAZZARI ("Culture in vitro di milza," *Hæmatologica*, 1925, **6**, 18–24, 2 figs.). In tissue cultures of the spleen the leucocytes migrate first into the medium to be followed by reticulum and connective-tissue cells. If the spleen is embryonic, the latter show a tendency to anastomose with one another. All migrated elements appear to be endowed for some days with considerable amœboid activity, and frequently change shape and situation with surprising rapidity. C. D. F.

Asphyxia and Histogenesis of Blood Platelets.—G. BIANCHINI ("Le asfissie e la piastrinogenesi," *Hæmatologica*, 1925, **6**, 52–78). Incomplete asphyxia from CO or CO_2 or other means, if carried out once or twice, causes in mammals (mainly kittens) a temporary increase in the number of circulating platelets and megakaryocytes in the spleen. If asphyxia is repeated several times the circulating platelets considerably decrease in number, while the megakaryocytes disappear from the spleen. The same effect is obtained by means of two or three injections of anti-platelet serum. But, if this is injected 18–20 times at intervals of a day, the megakaryocytes reappear in the spleen and the platelets in the circulating blood. These observations are in favour of the megakaryocytic genesis of platelets. C. D. F.

B. INVERTEBRATA

General.

Parasitism among the Helminths.—E. C. FAUST (*Amer Nat. New York*, 1925, **59**, 497–520, 2 text-figs., 2 pls.). The paper ranges over the three great orders of helminths, *Trematoda*, *Cestoda* and *Nematoda*, and discusses the evolution of parasitism within each. The final section deals with the adaptation of parasites to hosts both intermediate and final, methods of infection, whether by mouth or by skin penetration, and host immunity. T. G.

Mollusca.

γ. Gastropoda.

The Crystalline Style in Gastropods.—N. A. MACKINTOSH (*Quart. J. Microsc. Sci.*, 1925, **69**, 317–42, 3 text-figs., 2 pls.). Whereas in Lamellibranchia a crystalline style is very common, in Gastropoda it occurs in a few genera only. Crepidula possesses a style very like that of Lamellibranchs; it is contained in a sac separated from the intestine by dorsal and ventral typhlosoles. The head of the style lies in the anterior part of the stomach and impinges on the gastric shield. The epithelium cells of the style-sac are of moderate length and densely ciliated, the rootlets of the cilia extending through the length of the cells and becoming greatly thickened at the base. The epithelium is characterized by an intra-epithelial network of canals containing fibres which probably have a mechanical function. The same structures occur in the epithelium of the typhlosoles, the cells of which are longer and narrower than those lining the style-sac. The style is a straight transparent rod of gelatinous consistency; it is built up of co-axial layers surrounding a spiral core. It is principally composed of globulin and contains an amylolytic enzyme. Food is brought to the stomach embedded in a stream of mucus which becomes entangled with the head of the style. This mixes the contents of the stomach and supplies the starch-splitting ferment. The presence or absence of the style in different gastropods might be correlated with varying feeding habits. C. D. F.

Species of Choanomphalus and Allied Forms from Lake Baikal. – B. DYBOWSKI and J. GROCHMALIKI ("Przyczynki do znajomosci mieczaków jeziora Bajkalskiego: Wladislaviidæ nov. fam.," *Kosmos*, 1925, **50**, 819–81, 73 figs. on 1 pl.). The family is founded to include a number of forms of local occurrence. They have shells superficially resembling Valvata, but the radulæ appear to be very different; they are not, however, figured; the illustrations are of the shells. The radular formula of *Choanomphalus valvatoides* is (3), 10 + 5 + 10 + 1 + 10 + 5 + 10, (3) = 57; of *Ch. bicarinatus* 4 + 6 + 20 + 1 + 20 + 6 + 4 = 61; of *Ch. cryptomphalus* 5 + 6 + 20 + 1 + 20 + 6 + 5 = 63; of *Ch. schrencki* 4 + 7 + 1 + 7 + 4 = 23. In these enumerations accessory indistinct side plates are not included. E. W. B.

A Green Alga Parasitic in a Water Snail.—A. E. BOYCOTT (*North Western Naturalist*, 1926, 1, 10–11, 1 pl.). Breeding experiments have been carried on by the author and his helpers for the last five years (on the inheritance of sinistrality in *Limnæa peregra*): in 1924 in about half a dozen snails and in 1925 in about 30, out of some 650 breeding parents in each year, there were found conspicuous green spots in the parts of the body which are exposed when the snail is crawling. They proved to be small cysts embedded in the tissues filled with unicellular green algæ Appearances suggest that the algæ have multiplied *in situ*, and that their further progress through the tissues has been prevented by the capsule; sometimes they break through this boundary and continue growth as a solid mass; signs of a reactive growth of connective tissue are visible. They are not found in young specimens; there is no evidence that their presence shortens the snail's life. Pending further enquiry into the cysts and the cultures which have been made from them, the alga may be described roughly as a *Chlorella*. E. W. B.

δ. Lamellibranchiata.

Process of Hinge Formation in Bivalves.—T. H. HAYNES (*Proc. Malac. Soc.*, 1926, **17**, 44–8, 1 text-fig., 4 pls.). In the conversion of the thin flat shell of a young bivalve into the deeply scooped out adult shell, it seems that there must be a periodical or gradual release of the tie between the two valves. In 1924 the author maintained that bivalves periodically sever the hinge joint and construct a new one. Study of sections of *Pinctada maxima* shows that in this case the severance is gradual and by leverage, the new hinge being deposited internally while the oldest portion splits externally. The method employed does not appear to be always the same. E. W. B.

Brood Capsules of Sphærium corneum L.—B. FULIŃSKI ("O torbkach lęgowych u Galeczki rogowej," *Kosmos*, 1925, **50**, 116–63, 1 text-fig., 1 pl.). Detailed description of embryology of this hermaphrodite form. The brood capsules are formed in the gills, the cells of which contribute to the embryonic layers; the gill tissue subsequently returns to its normal condition. E. W. B.

Arthropoda.

α. Insecta.

Peristalsis in Malpighian Tubules.—L. EASTHAM ("Peristalsis in the Malpighian Tubules of Diptera—preliminary account: with a Note on the Elimination of Calcium Carbonate from the Malpighian Tubules of *Drosophila funebris*," *Quart. J. Microsc. Sci.*, 1925, **69**, 385–98, 3 text-figs., 1 pl.). The proximal regions of the Malpighian tubules of *Drosophila funebris* and *Calliphora erythrocephala* are provided with systems of circular and longitudinal muscles which are external to the basement membrane and continuous with those of the mid-gut. Each anterior tubule is in *Drosophila funebris* connected with the alar muscles of the pericardial septum by means of a terminal muscle. Peristalsis occurs in the proximal regions of the tubules, and is due to the contraction of the circular muscles. The tubules exhibit also a waving movement which is brought about by the longitudinal muscle-bands. Calcium carbonate is found in the Malpighian tubules of the adult Drosophila. It is not eliminated at the beginning of the metamorphosis, but passed to the gut about the sixth day of pupal life and expelled on the emergence of the adult. C. D. F.

Egg-follicle of Culex.—V. Nath (*Quart. J. Microsc. Sci.*, 1925, **69**, 151–75, 2 pls.). When a newly emerged mosquito is fed on food other than blood, the nuclei of all the cells of an egg-follicle pass through the synizesis stage. After 3–4 days' feeding on artificial food, the nuclei of the nurse-cells become differentiated from the nucleus of the oocyte. The egg-follicle does not develop further on artificial food. A feed on blood is essential for the deposition of yolk and the secretion of membranes. The nucleolus of the oocyte is an amphinucleolus and consists of proteids and nucleinic acid. The irregularity of the nuclear membrane of the germinal vesicle is due to the pressure of coarse yolk granules, and cannot be interpreted either as indicating a direct participation of the nucleus in the formation of yolk or as an artifact. In the germinal-vesicle stage the nucleus increases in size, and its chromatin is present in the form of very small granules. When the oocyte has almost reached its full size, the germinal vesicle shrinks and takes its position at the anterior end. The definite nucleus, from which the polar bodies and the female pronucleus arise, appears in the centre of the germinal vesicle, and has a definite membrane within which is a deeply basiphil mass of chromatin. The outer portion of the germinal vesicle merges into the cytoplasm of the oocyte when this has almost reached its full size and yolk formation is practically complete. The author describes also the structure and development of the chorion, vitelline membrane, striated collar and micropylar apparatus. This develops a short time before fertilization and degenerates immediately after the egg is laid. C. D. F.

Male Genitalia of Homoptera.—H. Singh-Pruthi ("The Development of the Male Genitalia of Homoptera, with Preliminary Remarks on the Nature of these Organs in other Insects," *Quart. J. Microsc. Sci*, 1925, **69**, 59–96, 1 pl.). In young Homoptera nymphs the male genital system consists of a pair of vasa deferentia, which are anteriorly continuous with the testes, and a pair of terminal ducts of hypodermal origin, which are at this stage not connected with the vasa deferentia. The terminal unpaired common ejaculatory duct arises later as a solid ingrowth of the integument; anteriorly it meets the blind ends of the paired hypodermal ducts. It soon acquires a lumen and freely communicates with the exterior. At a slightly later stage the paired hypodermal ducts, by a constriction in the horizontal plane along the whole of their length, become two pairs, a dorsal and a ventral, the accessory glands and the paired ejaculatory ducts respectively. The latter communicate with the vasa deferentia at a much later stage. The vesiculæ seminales develop from the distal ends of the vasa deferentia. The male genitalia of the adult Homoptera consist of two pairs of lateral appendages, the subgenital plates and the parameres, and a median copulatory organ, the ædagus. They are all borne by the ninth abdominal segment and develop from two pairs of appendages only, an outer and an inner, which appear as diverticula of the ventral region of the ninth segment. The outer pair develops into the subgenital plates, and the inner by longitudinal fission, becomes two pairs. The inner one of the two pairs so obtained, by fusion along the median line of its components, forms the ædagus, while the outer is transformed into the parameres. C. D. F.

Crystallization of Hæmoglobin in the Intestine of Hæmatophagous Insects.—G. Amantea ("Sulla cristallizazione dell' emoglobina nell' intestino di alcuni ematofagi," *Boll. Soc. biol. sper.*, 1926, **1**, 66–9). In the intestine of the dog-tick (*Ixodes ricinus*) the blood sucked from the host undergoes hæmolysis with subsequent crystallization of the hæmoglobin into relatively large prisms, or rectangular plates or rhombic plates. If, during the digestion phase, the same ticks are allowed to bite other animals, such as cats or guinea-pigs, the hæmoglobin crystallizes into the shapes which are characteristic of each species. C. D. F.

δ. Arachnida.

Cell Inclusions in the Oogenesis of Scorpions.—V. Nath (*London, Proc. R. Soc.* (B), 1925, **98**, 44–58, 4 pls.). In *Euscorpius napoli* and *Buthus judaicus*, whose oocytes contain ordinary yolk (not destroyed by fat solvents like acetic acid), the nucleolus increases in size and emits into the cytoplasm deeply basophil, round bodies. In *Palamnæus fulvipes madrapatensis*, the oocytes of which have no such yolk, the nucleolus remains quite inactive. The nucleolar extrusions become later acidophil and disappear as whole bodies. Although there is an overlapping between the initial stages of yolk formation and the last phase of nucleolar budding, the extrusions disappear when the yolk granules become prominent. However, indirect evidence strongly suggests that there is some relationship between nucleolar budding and yolk formation. The structure, fragmentation and ultimate transformation of the Golgi rods into the Golgi yolk in three genera of scorpions is described. In both *Euscorpius* and *Buthus* the Golgi yolk retains the same chemical constitution as the Golgi rods and does not contain any free fat. In *Palamnæus*, the oily yolk, which probably arises from the Golgi rods, contains free fat, like the Golgi yolk of *Lithobius* (Nath, 1924) and *Helix aspersa* (Brambell, 1923–4). The mitochondria (in the oocytes studied) are granular like those of most other eggs. In the centrifuged oocytes of *Euscorpius* the ordinary yolk is thrown down and the Golgi yolk forms the uppermost layer. The mitochondria and numerous irregularly scattered Golgi grains form the central area. The nucleus lies in the centre of this area. C. D. F.

ε. Crustacea.

The Olfactory Centres in Crustaceans.—B. Hanström (*J. Comp. Neurol.*, 1925, **38**, 221–50, 6 figs.). The olfactory neurons of the first order are bipolar cells and several of their central axons end together in the glomeruli of the first olfactory centre. In schizopods, stomatopods and decapods with normal eyes, this centre consists of one lobus subdivided in an anterior and posterior portion. In decapods with degenerated eyes (*Callianassa*, *Calocaris*) the same centré is more highly developed and connected with a lobus accessorius. The olfactory neurons of the second order are homologous to the mitral cells of vertebrates. Their axons form the connection with the second olfactory centre (tractus olfactorio-globularis). The second olfactory centre is represented by the glomeruli pedunculares which are the homologues of the calyces of the mushroom bodies (corpora pedunculata) in the brains of insects. These glomeruli consist of a medial and a lateral group. The medial group is more intimately connected with the olfactory paths and reaches a high degree of organization in decapods with degenerated eyes. The lateral group is more intimately connected with the visual paths and is more developed in decapods with normal eyes. C. D. F.

Anilida.

Oligochæta.

The Atrium and the Prostate Gland in the Microdrili.—H. R. Mehra (*Quart. J. Microsc. Sci.*, 1925, **69**, 399–444, 4 text-figs., 2 pls.). The prostate in *Nais elinguis* forms the wall of the vas deferens; in *Slavina punjabensis* it covers the atrium which is formed as an ectodermal invagination and is situated at the end of the vas deferens. The atrial epithelium in the sexually mature *Stylaria lacustris* and *Slavina punjabensis* is replaced by the prostatic secretion which passes through it; it is not composed of glandular cells. In *Naididæ* the prostate cells are peritoneal in origin and may surround the atrium or the vas deferens or both; they may be absent or rudimentary. In *Tubifex barbatus* the atrium is part of the vas deferens and hence mesodermal in origin. The prostrate lies near the seminal funnel above the ovary; in the early condition it is a deeply stained mass of nuclei with little cytoplasm. In the species of *Tubificidæ* investigated the prostatic secretion has a fibrillar appearance and forms in the centre of the gland. It flows into the atrial epithelium through an opening where the muscular wall is absent. The cytoplasm in the prostate cells is basophil as distinguished from the acidophil central part with the secretion. In *Tubifex* the gland contains basophil granules which pass with the fibrillary secretion into the atrium. In *Naididæ* and *Tubificidæ* the prostatic secretion is semi-fluid, does not contain mucin, but contains fat or some lipoid which reduces OsO_4 and stains like the dictyosomes of the Golgi apparatus. This paper contains also a discussion on the homologies of the atrium and prostate in the various families of the Microdrili, and a description of peculiar features in the structure of the vas deferens in *T. tubifex* and *Limnodrilus udekemianus*.

Yolk-formation in Lumbricus.—L. A. Harvey ("On the Relation of the Mitochondria and Golgi Apparatus to Yolk-formation in the Egg-cells of the Common Earth-Worm, *Lumbricus terrestris*," *Quart. J. Microsc. Sci.*, 1925, **69**, 291–316, 1 text-fig., 2 pls.). The yolk nucleus is merely a mass of mitochondria which arise as a cap of threads over the nucleus. This cap grows in size and density, migrates away from the nuclear membrane and breaks up into its component threads which become evenly spread throughout the cytoplasm. Mitochondria are not clearly defined in very young oogonia. The Golgi apparatus consists of a number of elements lying separate in the cytoplasm ; they probably are little plates or spheroids resembling blood corpuscles in shape and not rods. As fixed by Da Fano's technique, each element is a little plate with a very lightly impregnating centre and a very heavily impregnating rim. The Golgi elements probably arise from the cytoplasm. The nucleus contains two nucleoli : an early arising karyosome, homogeneous and solid in structure, and a plasmosome arising later, liquid in consistency and provided with an argentophil core. The karyosome disappears before the oocyte is half grown, but the plasmosome remains in the nucleus while the egg remains in the ovary. No visible nucleolar extrusions into the cytoplasm are found. Yolk probably arises from the cytoplasm ; no direct metamorphosis of either mitochondria, Golgi apparatus or nucleolus into yolk is observed.

C. D. F.

Nematohelminthes.

Nematoda.

A Nematode from the Iguana.—G. S. THAPAR ("*Ozolaimus* Dujardin 1845 (= Macracis Gedoelst 1916), a little-known Nematode Genus from the Cæcum of *Inguana tuberculata*," *J. Helm.*, 1926, **4**, 69–74, 6 text-figs.). This worm originally described as Ascaris by Rudolphi was later put into the genus *Ozolaimus* by Dujardin, who separated it from Oxyuris on its possession of two instead of three lips. Thapar has made a detailed study of the anatomy of both sexes of which he gives an illustrated account. He discusses the whole question of nomenclature and the classification of the worm which he considers has predominant oxyurid affinities. T. G.

A New Genus of Nematode from a Potato.—T. GOODEY ("*Hexatylus viviparus* gen. et sp. nov., a Nematode found in a Diseased Potato Tuber," *J. Helm.*, 1926, **4**, 27–30, 2 text-figs.). Amongst some potatoes suspected of being attacked by the eelworm *Tylenchus dipsaci*, but from which that parasite was absent, one tuber was found containing worms which on superficial examination resembled Tylenchus but were found on closer examination to be quite distinct. Only females were found and these possessed a mouth stylet with six basal swellings, an œsophagus without muscular bulb, a vulva well posterior in position and no post-vulvar uterine sac. The worms are assigned to a new genus *Hexatylus*. T. G.

A New Nematode from the Wallaby.—T. W. M. CAMERON ("On a New Species of Trichostrongyle worm from the Bennet's Wallaby," *J. Helm.*, 1926, **4**, 23–6, 3 text-figs.). Only one species of Trichostrongyle worm has been described prior to this from marsupials. Cameron records this small worm from the stomach and small intestine and comes to the conclusion that it is a new species. This is based on the characters exhibited by the male bursa. The bursal rays on one side are stouter and longer than on the other and give the bursa an asymmetrical appearance on which the specific name *asymmetricus* is based. T. G.

Lung-worm in Equines.—T. W. M. Cameron ("On the Morphology of the Adults and the Free-living Larvæ of *Dictyocaulus arnfieldi*, the Lung-worm of Equines," *J. Helm.*, 1926, **4**, 61–8, 2 text-figs.). The lung-worm occurring occasionally in horses and donkeys has been known for several years, having been originally found by Cobbold in 1882, but has never been fully described. Cameron has studied specimens obtained from a donkey killed in London and gives a detailed account of the structure of the adults of both sexes. He has also worked at the development of the larvæ which closely resemble that of *D. filaria* from sheep and *D. viviparus* from cattle. T. G.

Lung-worm in Cats.—T. W. M. Cameron ("On the Life-History of the Lung-worm *Synthetocaulus abstrusus*, hitherto confused with that of *Ollulanus tricuspis* in Cats," *J. Helm.*, 1926, **4**, 53–60, 2 text-figs.). A résumé is given of the observations of Leuckart and Cobbold on a nematode parasite, *Ollulanus tricuspis*, occurring in the stomach of cats and of certain larvæ which these two helminthologists took to be the larvæ of this worm. It is shown that these larvæ were in all probability not those of *Ollulanus tricuspis*, but belonged to another worm parasitic in the lungs of the cat, *Synthetocaulus abstrusus*, described originally by Müller as *Strongylus pusillus*. Cameron gives an account of his findings of these two parasites in cats examined at Edinburgh and of his feeding experiments with mice. He shows that the larvæ of the lung-worm pass through the stomach of the cat (hence their confusion with the larvæ of *Ollulanus* which is viviparous in habit), are probably passed out in the cat's droppings and presumably get eaten by mice, in the muscles of which they become encysted. Such encysted larvæ had been found many years ago by Leuckart who thought them to be developmental stages of *Ollulanus*. Cameron shows that when mice containing encapsuled larvæ are fed to cats the latter develop lung-worms. T. G.

On the Ascaris from Sheep.—T. Goodey (*J. Helm.*, 1926, **4**, 1–6, 3 text-figs.). The question of the specific identity of the Ascaris occasionally found in sheep and lambs is discussed in this paper. A large number of worms obtained from sheep in London have been examined and compared with typical specimens of *Ascaris lumbricoides* from the pig, and also with two specimens sent from Neumann's collection at the Toulouse Veterinary School which had been taken from a lamb in 1884, and were considered by Neumann to be a distinct species, viz. *A. ovis* of Rudolphi. The author shows that the shape of the lips, the arrangement of the head papillæ and the number and distribution of the papillæ of the male tail are the same in Neumann's specimens, in the worms from the sheep killed in London as in typical *A. lumbricoides* from the pig. The conclusion arrived at is that there is no such thing as *A. ovis* but only *A. lumbricoides*, which is common to sheep as well as pigs and a number of other hosts, including man. T. G.

On Strongyloides from a Baboon.—T. GOODEY ("Observations on *Strongyloides fülleborni* von Linstow 1905, with some remarks on the genus Strongyloides," *J. Helm.*, 1926, **4**, 75–86, 8 text-figs.). In 1905 von Linstow described *Strongyloides fülleborni*, a nematode parasitic in the small intestine of the chimpanzee. His account and figures left much to be desired in details of structure, and the author has studied the parasite afresh frem material obtained from a baboon, *Papio papio*. The free-living generation which develops in the fæces of the host is described and figured in greater detail than in the original account, and its anatomy is compared with that of the free-living generation of another species of the genus, viz. *S. stercoralis* from man. Certain differences between the two species are indicated and illustrated. T. G.

Platyhelminthes.

Turbellaria.

Rhynchodemus Britannicus. –E. PERCIVAL ("*Rhynchodemus Britannicus* n. sp.: a new British Terrestrial Triclad, with a Note on the Excretion of Calcium Carbonate," *Quart. J. Microsc. Sci.*, 1925, **69**, 343–55, 7 figs.). Length up to 90 mm.; colour variable, salmon-pink, sulphur-yellow, dirty-grey; a pair of sensory grooves border the anterior portion of the sole beneath the brain; the two grooves converge meeting in a pit situated at the tip of the body. Mouth mid-ventral; genital opening about 5 mm. behind it. The common genital duct may receive directly the atrium masculinum or the two may be connected by a penis duct. The vagina opens directly into the common genital duct, and its posterior end is connected with a diverticulum of the left gut-branch by means of a genito-intestinal duct. The vesicula seminalis is irregular in outline and is situated in the penis. The dorsal and dorsolateral ectoderm excretes at fairly regular intervals (about once daily) a granular material of the same colour as the worm which appears much paler after shedding it. The shedded material consists mainly of minute rhombic crystals, very likely of calcium carbonate. A similar excretion occurs in *R. terrestris*. C. D. F.

Cestoda.

Cestodes from Siluroids.—W. N. F. WOODLAND ("On some Remarkable new Monticellia-like and other Cestodes from Sudanese Siluroids," *Quart. J. Microsc. Sci.*, 1925, **69**, 703–29, 1 text-fig., 2 pls.). Those species of *Proteocephalid Cestodes* in which the testes are situated in the cortex may be described as of the Monticellia type. Of this there are three conditions: (*a*) the *Monticellia* in which testes, uterus, ovary and vitellaria are in the cortex; (*b*) the *Rudolphiella* in which the testes and vitellaria alone are in the cortex; and (*c*) the *Marsypocephalus* condition in which the testes are in the cortex, all other organs being medullary. Fuhrmann's genus *Gœzeella* is synonymous with *Monticellia* if the characters of the scolex are not considered as of generic value. The minute anatomy of two species of *Marsypocephalus* are described: *M. rectangulus* Wedl. and *M. heterobranchus* n. sp. from Nile Siluroid fishes. The author explains why he considers the genera of the *Proteoçephalidæ* to be four in number: *Proteocephalus*, *Monticellia*, *Rudolphiella* and *Marsypocephalus*, and points out that the *Tænia malopteruri* Frish, 1886, has the structure of the usual Proteocephalid type, save that the scolex possesses a rostellum and a broad band of booklets and is covered with spinelets. It is renamed *Proteocephalus malopteruri*. A new species of *Clestobotrium*, *C. clarias*, is described.

C. D. F.

Observations on the Genus Echinococcus Rudolphi, 1801.—T. W. M. Cameron (*J. Helm.*, 1926, **4**, 13–22, 2 text-figs.). The status of the genus Echinococcus is considered particularly in relation to the genus Tænia, and the view is expressed that it is a valid one separate from Tænia. A detailed account is given of the anatomy of *Echinococcus oligarthrus* (Diesing 1863) from a South American cat, *Felis yaguarundi*. Close attention has been given to the shape of the two sizes of hooks of which a number of drawings are given, and, on the constancy of the differences revealed, two new species in addition to *E. granulosus* and *E. oligarthrus* are made, viz. *E. longimanubrius* and *E. minimus*.

T. G.

Echinodermata.

Development of Astropecten irregularis.—H. G. Newth ("The Early Development of *Astropecten irregularis*, with Remarks on Duplicity in Echinoderm Larvæ," *Quart. J. Microsc. Sci.*, 1925, **69**, 519–54, 2 text-figs., 2 pls.). The normal development of *Astropecten irregularis* is described up to twenty-fifth day. About a third of the larvæ possessed two pore-canals and larval twinning was observed in two cases. Normal echinoderm larvæ probably possess a latent bilateral symmetry. As regards duplicity the following provisional conclusions are reached:—The various kinds of duplicity form a series. They are of the same nature as those found in vertebrate embryos and are probably due to similar causes. They may be determined by (*a*) alteration of the polarity of the egg; (*b*) interference with processes of early development affecting gastrulation; (*c*) physiological inhibition or mechanical deformation of the tip of the archenteron; their ultimate facies, in the latter case, is determined largely by excess or defect of nutrition.

C. D. F.

Protozoa.

Macronucleus of Infusoria.—V. A. Dogiel ("On the Influence of the Macronucleus on the Formation of New Morphological Characters in Infusoria," *Quart. J. Microsc. Sci.*, 1925, **69**, 611–7, 7 text-figs.). The typical form of *Diplodinium denticulatum* has six posterior spines, none of which is in relation to the elongated macronucleus. In the variety *Quinquecaudatum* five spines are present and the macronucleus is longer, reaching the base of spine III. In 6 p.c. of the individuals of this variety small spurs occur on the spines, and, when present, they are almost always found at the base of spine III. The tendency to production of spurs can be regarded as a new character not yet firmly established. The influence of the macronucleus on its development is shown by the prevalence of the spurs on spine III. which is more closely connected with it, and is likely to receive more formative energy from it than the other spines. S. D. K.

Observations on the Gregarines of Chiridota.—H. PIXELL GOODRICH (*Quart. J. Microsc. Sci.*, 1925, **69**, 619–28, 1 pl.). *Urospora chiridotæ*, previously described by Sars and by Dogiel under the name *Cystobia chiridotæ*, occurs in the antimesenteric blood vessel of the holothurian *Chiridota lævis*. The body is covered with stiff non-motile hairs; vacuoles containing a sphere (probably coagulated fluid) are sometimes seen after fixation, and possibly contain the substance which attaches the associates to each other. Sporogony stages are not described. *Lithocystis brachycercus* n. sp. occurs in the gut of the same host; young trophozoites push out through the intestinal wall, grow large between this wall and the peritoneum, and then bursting the latter are set free in the coelome, where they associate. Associates may differ in size, but the gametes are isogamous and non-motile. While the spore coat forms, the zygote divides into four sporozoites. The spores have extremely short flattened tails. S. D. K.

Gymnostomatous Ciliates.—M. S. MACDOUGALL ("Cytological Observations on Gymnostomatous Ciliates, with a Description of the Maturation Phenomena in Diploid and Tetraploid Forms of *Chilodon uncinatus*," *Quart. J. Microsc. Sci.*, 1925, **69**, 361–84, 11 pls.). *Chilodon uncinatus* is a ciliate belonging to the family *Chlamydodontidæ*. In division, the old pharyngeal basket is destroyed and two new baskets are formed, one in the anterior and one in the posterior part of the cell. In conjugation, the old baskets move to the place where the protoplasmic bridge is formed and remain there till the close of the first maturation division. They then move toward the posterior part of the cell and the new baskets appear just above the micronuclei. By the time conjugation is completed, the old baskets have been entirely absorbed and the new baskets are fully formed and in place. The same happens in the case of *Chlamydodon memosysme*. Also in *Porodon* cysts, the basket is destroyed and formed anew. The basket of *Chilodon* is quickly digested by artificial gastric juice, showing it to be protein in nature. If the basket is cut off in *Porodon* it is regenerated in 24 hours, showing that it is not necessary for the formation of new ones. The oral cilia are destroyed and formed anew both in conjugation and division. In pure-line cultures an animal B having a tetraploid or double the number of chromosomes normal for *Ch. uncinatus* appeared, the other animals dying out after its appearance. The animal with the diploid number of chromosomes was designated as A. The macronucleus is a spherical mass of granules, having in its centre an endosome containing an endobasal body. The endosome is overlaid by a network of chromatin. In division, the endobasal body divides, the chromatin network of the endosome breaks up, the endosome elongates and the granules around it form a felt-like ring which divides into two equal parts. The micronucleus consists of a core of plastin overlaid with a network of chromatin and containing an endobasal body. At the beginning of cell-division, the micronucleus moves from its place, the endobasal body divides and a parachute stage follows. The spireme breaks up into granules which fuse into 4 chromosomes in the case of animal A and 8 in the case of B. The nucleus then divides, the daughter nuclei assuming their resting aspect. There are three maturation divisions during conjugation. At the end of the first the chromosomes spin out and a short resting stage occurs. After the second the number of chromosomes is reduced to one-half. After the third, the animals separate. The amphinucleus forms a spindle immediately after fusion, 4 chromosomes condensing in animal A and 8 in B. These split and the nucleus divides forming the future micronucleus and macronucleus. The micronucleus reaches the resting stage while the macronucleus enlarges until it nearly fills the cells. It then condenses to normal size, the endosome is differentiated and the micronucleus moves to its place in the posterior end. The old macronucleus is gradually absorbed. C. D. F.

On Proterythropsis vigilans n. sp.—S. M. Marshall (*Quart. J. Microsc. Sci.*, 1925, **69**, 177–84, 1 text-fig., 1 pl.). A new species of *Proterythropsis* is described—*P. vigilans*: small ovoidal form, length 1·4 times the greatest width; girdle a descending left spiral of one and a quarter turns, with a continuation on to the tentacle; sulcus describing a turn. Ocellus of compact type, posterior; lens pear-shaped; red pigment-mass with reddish-yellow core. Slender tentacular process carrying continuation of girdle. Compound capsules present, each containing six smaller capsules. It occurred at Millport in March and April, 1923 and 1924.—The coloured drawing illustrating this paper is particularly beautiful and interesting. C. D. F.

Micronuclei of Spirostomum.—A. Bishop ("A Study of the Micronuclei of *Spirostomum ambiguum major* during Division," *Quart. J. Microsc. Sci.*, 1925, **69**, 661–9, 2 pls., 1 text-fig.). *Spirostomum ambiguum* has several micronuclei applied to the moniliform macronucleus. In the resting phase they are small and homogeneous. At the beginning of fission macro- and micro-nuclei migrate forward, the former condensing into an oval mass, the latter enlarging. All nuclei then migrate back again, the micronuclei dividing. At the beginning of this division the chromatin condenses in one or more bands at the periphery of the micronucleus. Later two polar cones appear at right angles to each other, but without centrosomes or rays; the chromatin bands lie at the bases of the cones, but are not restricted to this area. The polar cones then separate, an ordinary spindle forming between them; the chromatin becomes condensed in a thick equatorial plate and later two plates are seen moving apart to opposite poles. Chromosomes are not distinguishable. After formation of the daughter nuclei the spindle breaks down. All the micronuclei divide, but the daughter nuclei are not evenly distributed between the daughter cells. The macronucleus divides after the division of the micronuclei is complete.

S. D. K.

BOTANY.

(*Under the direction of* DR. A. B. RENDLE.)

GENERAL,

Including the Anatomy and Physiology of Seed Plants.

Structure and Development

Vegetative.

Structure of Phloem in Dioscorea.—T. G. MASON ("Preliminary Note on the Physiological Aspects of certain undescribed Structures in the Phloem of the greater Yam, *Dioscorea alata* Linn.," *Dub. Sci. Proc. R. Soc.*, 1926, **18**, 195–8, 2 pls.). A preliminary account of abnormal phloem observed in the greater yam. A longitudinal section through a node shows two masses of vessels and xylem parenchyma forming a plexus close to the insertion of the petiole. Beneath them are a number of ovoid or irregularly-shaped "bast-glomeruli." The latter form the ends of a corresponding number of giant sieve-tubes, being usually connected with the sieve-tubes by funnel-shaped cells or "bast-tubules" of considerable length. The glomeruli themselves are composed of long prismatic cells arranged in definite lines. Eleven other species were examined and glomeruli of similar structure were found in all except *D. villosa* and *D. tokora*; in *D. nipponica* their presence was not clear. Where they were seen they closely resembled those in *D. alata*, but they were more complex in *D. dumetorum*. In all species where they occur (as also in *Tamus communis*) the wood-plexus is relatively inconspicuous. Their reaction to stains makes it probable that they secrete enzymes which are transmitted to the xylem parenchyma and thence to the tracheæ of the wood-plexus. It is equally probable that they function as organs for the abstraction of coagula for storing in the sieve-tubes. The glomeruli appear to offer an insuperable barrier to the rapid longitudinal movement of carbohydrates in the phloem. S. G.

Reproductive.

Polyembryony in Conifers.—J. T. BUCHHOLZ ("Origin of Cleavage Polyembryony in Conifers," *Bot. Gaz.*, 1926, **81**, 55–71, 2 pls., 2 figs.). An examination and discussion of the evidence as to the origin of cleavage polyembryony. It is shown that the latter must have originated before the adjustment of developmental selection within the ovule, when only one egg was fertilized at a time, possibly during the transition from independent microgametophytes to pollen-tubes. The destructive competition in conifers favours the development of stiff, long suspensors and reversion from cleavage to simple polyembryony. Morphological evidence supports the view that most, if not all, living conifers have passed through a stage of polyembryony by cleavage, so that this feature is primitive, although in some cases it is retained as a form of specialization. S. G.

CRYPTOGAMS.

Pteridophyta.

Appendages of Ferns.—F. O. BOWER ("The Dermal Appendages of the Ferns," *Ann. Bot.*, 1926, **40**, 479–90). A review of the dermal hairs and scales observed on the various groups of the ancient or more primitive ferns—Botryopteridaceæ, Ophioglossaceæ, Marattiaceæ, Osmundaceæ, Schizæaceæ, Gleicheniaceæ, Hymenophyllaceæ, Dicksoniaceæ, Plagiogyriaceæ, Proto-cyatheaceæ, Cyatheaceæ, Matoniaceæ, Dipteridaceæ and their derivatives. The simple hair should be regarded as primitive; from it are derived the scale and bristle. Dermal appendages are features of value in phyletic argument. A. G.

Bryophyta.

Alaskan Mosses.—J. M. HOLZINGER and T. C. FRYE ("Mosses of the Bureau of Soils Kelp Expedition to Alaska," *Publ. Puget Sound Biol. Stat.*, 1921, **3**, 23–64, 4 pls.). Report on the mosses collected in 1913 by the expedition at times when it was impossible to carry on oceanic research. The specimens were all gathered on the coast, and represent 198 species with 25 varieties; two species and a variety are new to science. *Geheebia gigantea* and *Zygodon reinwardti* are new records for North America. The flora of Alaska is enriched by 44 species. Critical notes are given on several of the species. A G.

Thallophyta.

Algæ.

Dutch Flagellatæ.—A. C. J. VAN GOOR ("Über einige bemerkenswerte Flagellaten der holländischen Gewässer," *Rec. trav. bot. néerland.*, 1925, **22**, 315–9, 3 figs. in text). A discussion of some remarkable Flagellatæ found by the late Dr. Van Goor in the waters of Holland. *Codomonas Pascheri* is the type of a new genus and species. A. G.

Dutch Peridineæ.—A. C. J. VAN GOOR ("Einige bemerkenswerte Peridineen des holländischen Brackwassers," *Rec. trav. bot. néerland.*, 1925, **22**, 275–91, 5 figs. in text). The late Dr. Van Goor here discusses and describes five remarkable Peridineæ which he had found when investigating the phytoplankton of the brackish waters of Holland. Two of them are new to science. A. G.

Dutch Eugleninеæ.—A. C. J. VAN GOOR ("Die Eugleninеæ des holländischen Brackwassers mit besonderer Berücksichtigung ihrer

Chromatophoren," *Rec. trav. bot néerland.*, 1925, **22**, 292–314, 14 figs. in text). A discussion of fourteen Englenineæ belonging to five genera and found in the brackish waters of Holland. Special attention is directed to their chromatophores. Two of the species are new to science. A. G.

Rhizosolenia.—R. C. McLean ("Cellular Regeneration in *Rhizosolenia setigera* Brightwell," *Ann. Bot.*, 1926, **40**, 506, figs.). Note on an instance of abnormal repair of a broken marine diatom. A. G.

Nitzschia actinastroides.—A. C. J. Van Goor ("Über *Nitzschia actinastroides* (Lemm.)," *Rec. trav. bot. néerland.*, 1925, **22**, 320–3, 2 figs. in text). Lemmermann's *Synedra actinastroides* was found after careful investigation by the late Dr. Van Goor to be really a *Nitzschia*, and to belong to the group Lanceolatæ of that genus, being allied most nearly to *N. palea* (Kütz.) W. Sm. A. G.

Panama Plankton.—C. H. Ostenfeld and G. Nygaard ("On the Phytoplankton of the Gatun Lake, Panama Canal," *Dansk Botanisk Arkiv*, 1925, **4**, nr. 10, 1–16, 20 figs.). To test the purity of the water of the Gatun Lake samples of the plankton were taken by the Danish Oceanographical Expedition in S.S. "Dana" when passing through the Panama Canal. The lake is 85 ft. above sea level; its water proved to be free from sodium chloride; its flora is of a completely fresh-water character, containing several Desmids; and the whole growth of marine algæ and barnacles on the ship's bottom was destroyed during three days' sojourn in the lake. On the whole the plankton of the lake has much the same character as that of two lakes in Guatemala. G. Nygaard adds an annotated list of the thirty-four species, three of which are new to science. A. G.

Soil Algæ.—B. Muriel Bristol Roach ("On the Relation of certain Soil Algæ to some Soluble Carbon Compounds," *Ann. Bot.*, 1926, **40**, 149–201, 1 pl. and 13 figs.). A discussion of methods of isolation and purification of soil algæ, and of their growth on various culture media, and an investigation of the rate of growth of *Scenedesmus costulatus* Chod. var. *chlorelloides*, a new variety, in pure culture in a nutrient solution containing various soluble carbon compounds. A. G.

Jan Mayen Island.—Johannes Gandrup ("A Botanical Trip to Jan Mayen," *Dansk Botanisk Arkiv*, 1924, **4**, nr. 5, 1–35, 7 figs.). A few hurried visits were made to this island in August 1919. Among the results are the following lists:—Fresh-water Diatomaceæ, by J. Boye Petersen, 60 species; Marine Algæ, by L. Kolderup Rosenvinge, 18 species; Bryophyta, by A. Hesselbo, including 25 hepatics and 67 mosses. A. G.

Structure of Nitella.—Kathleen M. Drew ("The 'Leaf' of *Nitella opaca* Ag., and Adventitious Branch Development from it," *Ann. Bot.*, 1926, **40**, 321–48, 55 figs. in text). The author describes in detail the structure of the "leaf" of *Nitella opaca*, and also the occurrence and development of the adventitious branches at the upper node of the "leaf." In *N. opaca* the "leaf" is extremely simple, but probably is derived from a more complex type. Comparison is made with other types. Adventitious branches are of pro-embryonic character. A. G.

Iodine in Algæ.—Camille Sauvageau ("Sur quelques Algues Floridées renfermant de l'Iode à l'état libre," *Bul. Stat. Biol. d'Arcachon*, 1925, **22**, 1–43, 2 figs.). An investigation of the occurrence of iodine in red algæ shows that iodine is accumulated in special cells, and that it exists in the free state in *Asparagopsis*, *Bonnemaisonia*, *Falkenbergia.* This iodine instantly stains starch paste, is soluble in chloroform, and gives a reaction with cresyl blue. The latter reaction is so delicate as to reveal traces of iodine dissolved in the cell sap. In plants kept in captivity the free iodine is diminished and passes into combination with mineral bases. A. G

Bromine in Algæ.—Camille Sauvageau ("Sur quelques Algues Floridées renfermant du Brome a l'etat libre," *Bul. Stat. Biol. d'Arcachon*, 1926, **23**, 1–21, 1 fig.). Investigation shows that certain special cells in *Antithamnion* and *Antithamnionella* contain free bromine. Such a special cell contains protoplasm, a nucleus, and chromatophores, also a substance of strongly osmotic property, and a refractive homogeneous material. This latter material is soluble in fresh water, and is coagulable by sea salts, by fluorescin and by eosin, it is reddened by Millon's reagent, and may possibly belong to the phenol group. To it bromine is fixed by a kind of adsorption. As in the case of iodine, so also bromine in these cells is present in the very finest state of division. But while iodine quickly leaves the dying cell and forms iodides, the bromine cells resist putrefaction for some weeks; but it is unknown whether this is due to the cell membrane or to the bromine itself.

A. G.

Photosynthesis of Algæ.—Floyd W. Gail ("Photosynthesis in some of the Red and Brown Algæ as related to Depth and Light," *Publ. Puget Sound Biol. Stat.*, 1922, **3**, 177–93, 3 figs.). In clear calm weather the maximum of photosynthesis of red algæ occurs at depths indicated by the following numbers:—*Dasyopsis plumosa*, *Rhodymenia pertusa*, 15 m.; *Halosaccion glandiforme*, *Agardhiella tenera*, 15 m.; *Prionitis Lyallii*, 8 m.; this utilization of the reduced solar energy is probably facilitated by the presence of the red pigment. In brown algæ the maximum occurs at 1 to 8 m. for most species; exceptions are *Fucus evanescens*, *Desmarestia ligulata*, 15 m. In Puget Sound the greatest depth at which photosynthesis occurs is about 35 ft. A. G.

Algæ and Light.—Victor E. Shelford and Floyd W. Gail ("A Study of Light Penetration into Sea Water made with the Kunz Photo-Electric Cell with particular Reference to the Distribution of Plants," *Publ. Puget Sound Biol Stat.*, 1922, **3**, 141–76, 7 figs.). The results of these investigations show that in calm clear weather 25 p.c. of the light is shut out by the surface of the water, while in rough weather 60–70 p.c. or more is excluded. The first metre of water below the surface shuts out about 20 p.c. Of the shorter wave-lengths of light

8–10 p.c. penetrate to a depth of 10 m. The zone for the brown algæ is at depths between 5 and 20 m., the majority occurring at about 10 m., where the shorter wave-lengths of light are about 10 p.c., and the red waves 0·99 p.c. of full sunlight. The red algal zone is between 10 and 30 m. in depth, especially between 15 and 25 m., where the shorter wave-lengths are between 10 and 2 p.c., and the red between 0·99 and 0·0032 p.c. of full sunlight. In rough water the depth of the algal zones is considerably less. A. G.

Desmarestia dudresnayi.—CAMILLE SAUVAGEAU ("À propos de la rencontre du *Desmarestia dudresnayi* Lamx. dans le golfe de Gascogne," *Rev. Algol.*, 1925, **2**, 1–13). An investigation of *Desmarestia dudresnayi*, a brown alga growing at a depth of about 13 fathoms, recorded from the west coast of France, Ireland, S.W. England, Bay of Biscay. wide spread in the sea, but rare in collections. Originally named by Lamouroux in 1819, it was called *D. pinnatinervia* by Montagne in 1842, and was regarded as a form of *D. ligulata* by J. Agardh and other authors. Sauvageau brings out the salient characters of the species in a new description A. G.

Macrocystis.—E. M. DELF and M. LEVYN (NÉE MICHELL) ("Reproduction in *Macrocystis pyrifera* Ag.," *Ann. Bot.*, 1926, **40**, 503–6, 2 figs.) An account of some interrupted investigations made in South Africa into the germination of the zoospores of *Macrocystis pyrifera*, and of the young sporophytes which appeared in the cultures. The zoospores are of two sizes. And though no antheridia were observed in the cultures, the evidence seems to point to the presence of a bisexual gametophyte generation as in other Laminariaceæ. A. G.

Nereocystis.—GRACE E. HOWARD ("Extraction and Separation of the Pigments of *Nereocystis luetkeana*," *Publ. Puget Sound Biol. Stat.*, 1921, **3**, 79–91). Experiments were made to extract the pigments from *Nereocystis* on the lines of those adopted by Willstätter for analysing *Urtica* and other phanerogams (1915). Pigments easily extracted from kelp are :—Chlorophyll A, Chlorophyll B, Carotin, Xanthophyll, Fucoxanthin. In chlorophyll, magnesium is present, probably also chlorophyllase. Kelp chlorophyll can be put into a colloidal state, which carries a negative charge. This pigment cannot be extracted by pure solvents. A. G.

Sieve Tubes of Nereocystis.—GEORGE B. RIGG ("Some Physiology of the Sieve Tubes of *Nereocystis*," *Publ. Puget Sound Biol. Stat.*, 1925, **3**, 311–30, 2 pls. and 1 fig.). A short account of the structure of the plant is given. The function of the sieve tubes is to convey photosynthetized materials to points of growth or of temporary storage. The presence of proteins can be demonstrated. The callus masses appear to originate from the protoplasm and to be correlated with the increasing age and failing function of the sieve tubes. It does not seem probable that carbohydrates are conducted by these tubes to any great amount. A. G.

Enzymes of Nereocystis.—LEONA SUNDQUIST ("Some Enzymatic Actions of *Nereocystis luetkeana*," *Publ. Puget Sound Biol. Stat.*, 1925,

3, 331–6). This alga contains a ferment which hydrolyzes the starches of higher plants to reducing sugars; its activity is inhibited by heat. A water-soluble substance was found which yields reducing sugars when hydrolyzed with HCl. A third ferment which hydrolyzes pentosans to pentose sugars was not definitely determined. A. G.

Fungi.

Viability of Potato-wart Disease.—MARY D. GLYNNE ("Viability of the Winter Sporangium of *Synchytrium endobioticum* (Schilb.) Perc., the Organism causing Wart Disease in Potato," *Ann. Appl. Biol*, 1926, **13**, N. 1, 19–36, 1 diagram). The author first describes a method of determining the living or dead condition of sporangia in the soil: this was achieved by means of stains; the reaction to staining betrays the condition of the fungus: methods and results are given in detail. In connection with this section of her work the writer next describes her method of extracting winter sporangia from the soil; this is done mainly by the use of chloroform which does not injure the sporangia. A third section deals with the effects of temperature on the viability of the sporangia, both wet and dry. She found that a much higher temperature was necessary for success in killing the sporangia in dry conditions than in wet. In heating soil for the purpose of getting rid of the sporangia it is very important that it should be uniformly damp. A. L. S.

Potato-wart Disease.—KATHERINE CARTWRIGHT ("On the Nature of the Resistance of the Potato to Wart Disease," *Ann. Bot.*, 1926, **40**, 391–5, 1 pl.). The research was undertaken to discover if possible the causes that contributed to susceptibility or to immunity of the host. Changes of temperature had no effect; there was no anatomical differences in the young shoots; the healthiest tubers took the disease most readily. In an immune potato, "Great Scot," the zoospore of the parasite behaved at first as in susceptible hosts and penetrated readily the cells of the young shoot. After that it became smaller, showing signs of disintegration. Finally, it was dissolved and disappeared from the host-cell. The resistance, it was concluded, was due to some physiological characteristic of the epidermal cells of the host which prevented the development of the parasite. A. L. S

Aithalomyces: a New Genus of Capnodiales.—N. N. WORONICHIN ("*Aithalomyces*, eine neue Gattung der Capnodiales," *Ann. Mycol.*, 1926, **24**, 145–9). In his paper Woronichin describes other genera of Capnodiales, such as *Antennulariella*, that resembled his new fungi in the form of mycelium and perithecia, but differed in the 3-celled fusiform brown spores. He found the first of his new species *Aithalomyces arctica* on *Phyllodoce taxifolia*, *Empetrum nigrum* and *Arctostaphylos Uva-ursi* in Russian Lapland. A second species, *A. Rhododendri*, occurred on *Rhododendron chrysanthum* in Siberia. A. L. S.

Perithecia of Microthyriaceæ.—RUTH WINIFRED RYAN ("Development of the Perithecia in the Microthyriaceæ and a Comparison with

Meliola," *Mycologia*, 1926, **18**, 100–10, 4 pls.). The author gives an account of perithecial development in the family. The perithecia may arise from a cell of the mycelium, from hyphopodia, from a short lateral branch or from a nodulate cell. In *Meliola* the perithecia always arise from hyphopodia. In that particular and in others, *Meliola* differs from the genera of Microthyriaceæ and has been placed by R. W. Rosen in Perisporiaceæ. A bibliography of papers cited is given, and on the plates is traced the development of the genera studied. A. L. S.

Ascomycetes of Bulgaria.—JAROMIR KLIKA ("Ein Beitrag zur Askomyceten-flora von Bulgarien," *Ann. Mycol.*, 1926, **24**, 133–6). The collection was made by the late Dr. F. Bubak in 1907 and 1908. In order that his work might not be lost it has been completed by Klika. It contains 71 species, 3 of which have been determined by Klika as new to science. This is an important contribution as little is known of fungi in Bulgaria. A. L. S.

Penicillium Species.—ELIZABETH DALE ("Note on Three New Species of *Penicillium*," *Ann. Mycol*, 1926, **24**, 137). This note forms an addition to a paper published by the author in the same magazine in 1914. Among the many cultures made by her, and described in her paper, occurred some that were not determined. Two from chalky soil she now publishes as *Penicillium echinatum* and *P flexuosum*. A third form from a sample of peat she has named *P. sacculum* on account of the swollen sterigmata. A. L. S.

Study of Sphæropsidales.—W. ANDREW ARCHER ("Morphological Characters of some Sphæropsidales in Culture, with Reference to Classification." *Ann. Mycol.*, 1926, **24**, 1–84, 8 pls., 18 text-figs.). The author here attempts by cultures of the fungi in question to clear up the confusion between different genera. This confusion has arisen from the fact that certain fungi vary considerably at different stages of development. Sphæropsideæ are in general the pycnidial stage of Ascomycetes. An historical account is given of the group, a description of culture methods, and a list of 32 species which have been subjects of experimental culture. The morphology of each is described, and their growth both on the host and in culture. In a final section the author gives general conclusions and summary. In this are included an account of primordia in general—present in all the higher fungi, but absent in the Hyphomycetes. In the latter group mycelial aggregates are occasionally formed—in sporodochia, for instance. Pycnidia, their development and various forms, come under observation along with pseudopycnidia, the latter according to Archer not true bodies, and hitherto not rightly understood. In a discussion on stroma formation he decides that all pycnidia are stromatic; the portion termed the wall is truly the stroma—"the stroma is the product of the proliferation of hyphæ after the formation of a distinct primordium." As to systematy the writer seems to conclude that the position of generic rank for these stage forms must be accepted for the sake of convenience, but that by thorough investigation and more knowledge superfluous species and genera may gradually be eliminated. A bibliography of 110 items adds materially to the value of the paper. A. L. S.

Smuts of Porto Rico and the Virgin Islands.—H. H. WHETZEL and F. D. KERN (*Mycologia*, 1926, **18**, 114–24, 1 pl.). The writers have aimed at collocating all that is known as to the occurrence of smut disease in these islands by examining not only herbaria but the literature dealing with the subject. They have found one new species, *Tolysporella sporoboli*, but on the whole the number of species is relatively few. A bibliography of the papers consulted is appended. A. L. S.

Contribution to the Systematy of Uredineæ: VI.—P. DIETEL ("Kleine Beiträge zur Systematik der Uredineen VI.," *Ann. Mycol.*, 1926, **24**, 130–2, 3 text-figs.). The Uredines in question are all from the Western Hemisphere. Two are from the West Indies, *Dicheirina binata* and *Diabole cubensis*, in both of which two or more teleutospores are borne on one stalk; and one, *Mikronegria*, from Chile, in which the main stalk produces at the tip a number of secondary stalks each one bearing a uredospore. The systematic position of the last-mentioned genus is somewhat obscure, but possibly near to *Coleosporium*. A. L. S.

New Amanita from Kansas.—H. R. ROSEN (*Mycologia*, 1926, **18**, 97–9, 3 pls.). The author describes an unusually large species of *Amanita*; the stems are 10–15 cm. high, the whole carpophore up to 20 cm., the pileus 10–15 cm. broad, and yellow to creamy-white in colour; the whole plant, named *Amanita arkansana*, is quite distinct from *A. cesaria*. The fungus was collected in October, but Rosen believes that it is a summer plant. A. L. S.

Stratified Sporophores of Polyporus gilvus.—RAY R. HIRT (*Tom. cit.*, 111–3). The contention of the author is that the new hymenial layer in *Fomes* is not always the product of the older sporophore. He proved this by attempting to grow in culture mycelium from an exhausted sporophore with no result, while mycelium from the infected wood grew readily. The mycelium itself is perennial. A. L. S.

Note on the Genus Mucidula.—M. BOURSIER ("Note sur le genre *Mucidula* Pat.," *Bul. Soc. Mycol. France*, 1926, **40**, 332–3). The genus was based on *Armillaria mucida*. In his study of the group Boursier has transferred to it several other species, including *Collybia radicata* and *C. longipes*. The spores of all the *Mucidulæ* are globose and very large; the hymenium contains fatty substances, and colours a deep red with Sudan red. The cystidia alone remain uncoloured.
A. L. S.

Reversed Pileus of Laccaria laccata.—G. BILLIARD and J. FAIVRE ("Superposition d'un chapeau inversé chez *Laccaria laccata*," *Paris, Bul. soc. mycol.*, 1926, **40**, 334–5). The second pileus closely adhered to the first, but with the lamellæ uppermost The attachment had evidently taken place at an early stage of development. A. L. S.

New Genus of Phallineæ.—K. M. CURTIS ("The Morphology of *Claustula Fischeri* g. et sp. n.: a New Genus of Phalloid Affinity," *Ann. Bot.*, 1926, **40**, 471–7, 1 pl. and 6 text-figs.). The fungus was found on one of the hills near Nelson, South Island, New Zealand.

After examination K. Curtis decided it to be a new genus and species, *Claustula Fischeri*. According to her diagnosis it has: "Volva ovate, up to 2 in. diam., white at first, finally coloured, of two layers, inner gelatinous, outer thin, rupturing at maturity into several pointed segments: receptaculum globose, permanently closed, partly ejected from volva at maturity, with large central cavity and wall of meshwork; gleba in small chambers on inner surface of receptaculum; spores brown, smooth, cylindrical, with persistent basal papilla." The various characters are illustrated in figures on the plate. A. L. S.

Mycological Studies.—RENÉ MAIRE ("Études Mycologiques," *Paris, Bul. soc. mycol.*, 1926, **40**, 293–317, 1 text-fig., 7 pls., partly coloured). René Maire has given full accounts of a number of the larger fungi from various European and N. African localities. He makes large use of chemical reactions in his study: thus for a species of *Lactarius* the reagents employed are iodine, sulphuric acid, potash, nitric acid and ammonia. All the species are not, however, subjected to all or any chemical tests. Many new species and new combinations are included. The new genera are:—*Rhodocybe*, in the *Tricholoma* group; *Rhodotus*, based on *Agaricus palmatus*; and *Chondrogaster*, one of the Hypogaeæ near to *Melanogaster*. A. L. S.

Toxicity of Amanita echinocephala.—E. CHAUVIN ("*Amanita echinocephala* Vittad. est-elle vénéneuse?" *Paris, Bul. soc. mycol.*, 1926, **40**, 341). Chauvin experimented with a maceration of the fungus by injection into a snake. No results followed, but the author holds that the fungus is probably poisonous to some extent. A. L. S.

Poisonous Fungi.—E. MARTIN-SANS ("Les Empoisonnements par les Champignons en Août et Septembre 1924," *Tom. cit.*, 342–8) The author reports fourteen group cases of poisoning with seventeen deaths. In most of the cases specially detailed the fungus was a species of *Amanita* —*A. phalloides*, *A. verna*, *A. virosa*. In one case *Lepiota helvola* had been eaten, and also proved poisonous. A. L. S.

Research on Dermatomycetes.—ARTURO NAUNIZZI ("Ricerche sui rapporte morfologici e biologici tra Gymnoascacee e Dermatomiceti," *Ann. Mycol.*, 1926, **24**, 85–129, 6 pls., 12 text-figs.). The writer has published a weighty contribution to our knowledge of medical fungi—those minute forms that infest the animal skin. By means of cultures he has traced a connection with Gymnoascaceæ, especially with *Ctenomyces serratus* in so far as mycelial development is concerned. There does not seem to be any formation of asci. Finally, he classifies family Gymnoascaceæ with sub-family Gymnoasceæ in two sections:—I. Eugymnoasceæ, including *Myxotrichum*, *Gymnoascus*, *Ctenomyces*, etc. Sect. II. Notho-gymnoasceæ, with two genera, *Myxotrichella* and *Aleleothylax*. Sub-family II. Atelogymnasceæ, which includes the various Dermatophytes, *Trichophyton*, *Epidermpohyton*, etc. He describes *Gymnoascus*, and especially *Ctenomyces*, as living on animal substances (?), and thus approaching Dermatophytes. Details of cultures are given, and a long bibliography is added. A. L. S.

Red Gelatinous Growth on Vines.—E. FOEX and A. AYOUTANTIS ("D'une production rouge à consistance gélatineuse que revêt parfois la vigne au printemps," *Paris, Bul. soc. mycol.*, 1926, **40**, 318–31, 1 text-fig., 1 pl.). The substance was found on vines in the neighbourhood of Tours. It was a spongy network of fungoid nature in the meshes of which were lodged green algæ. These algæ did not seem to have any definite connection with the mycelium of the fungus. Numerous bacteria, some of them in zoogloeæ, were also present. The substance increased rapidly in size, and was proved to have none of the essential lichen characteristics. Finally, it was identified with *Pionnotes biasolettianum*, now classified as *Fusarium biasolettianum*. It grows on the gummy exudations of the vine as a saprophyte, or perhaps as a parasite on neighbouring tissues. A. L. S.

Pepper Disease.—B. B. HIGGINS ("Anthracnose of Pepper, *Capsicum annuum* L.," *Phytopathology*, 1926, **16**, 333–45, 2 pls.). At least five species of *Glœosporium* or *Colletotrichum* were isolated from the pepper plant, but only one, *Glœosporium piperatum*, was actively parasitic; it attacks the fruits in all stages of development and occasionally produces spots and girdling of stem and branches. The other species are wound parasites. The germinating spores of *G. piperatum* produce one or more appresoria which become firmly attached to the cuticle of the pepper pod and send their hyphæ through the cuticle into the interior of the pod. Entrance is gained by a cutin-dissolving substance, and the fungus mycelium secretes some toxic substance which kills the host-cells before they are penetrated by the hyphæ. Cutinized and lignified membranes are more resistant to the fungus than cellulose membranes. The spores of the fungus may become attached to the seed of the pepper, and attack the young seedlings as they emerge from the seed coat. A. L. S.

Foot-rot Disease of the Pea.—GRACE G. GILCHRIST ("The Nature of Resistance to Foot-rot caused by *Ascochyta* sp., and some other Fungi in the Epicotyl of the Pea," *Phytopathology*, 1926, **16**, 269–76, 1 pl.). The decay of the stem base in garden peas has been of considerable economic importance in the United States, and the cause of the trouble has been traced to attacks by several fungi, among them, *Ascochyta* sp., the subject of this investigation. The special susceptibility of the epicotyl has been examined. It has been proved that just at that region there is a deficiency or absence of cuticle. As some peas showed a higher degree of resistance to infection experiments, it was found that these had a thicker cuticle at the base of the epicotyl. A. L. S.

Contribution to the Parasitic Flora of Sasznitz.—R. LAUBERT ("Ein Beitrag zur Schmarotzerpilzflora von Sasznitz," *Hedwigia*, 1926, **64**, 93–102). The list comprises mostly Micromycetes growing on leaves: the locality examined is the eastern part of the Jasmund Peninsula. The author has arranged the list alphabetically according to the host, beginning with *Acer campestre* and its parasite *Uncinula Aceris*, and ending with *Viola silvatica* attacked by *Puccinia Violæ*.

A. L. S.

Lichens.

Lichen-flora from the Neighbourhood of Krimml in Salzburg.—Jos. Anders ("Zur Flechtenflora der Umgebung von Krimml in Salzburg," *Hedwigia*, 1926, **64**, 103–26). The author gives a sketch of the country in which he collected. The centre was the Krimmler Waterfall, and the spray rising from it supplied a moisture-laden atmosphere which proved very favourable to lichen growth on trees and rocks. An alder thicket provided trees covered with lichens such as *Lobaria pulmonaria*, *Nephromæ*, *Parmeliæ*, and crustaceous species. Other types of lichen were found in the pine-woods. The rocks composed of gneiss and mica-schist were also covered with foliose and crustaceous forms—a very large number of individual lichens, though belonging to few genera or species. He found also many specimens in which spores were lacking, and determination impossible. On the higher reaches he noted the abundance of *Parmelia stygia* and *P. encausta*, and the frequent occurrence of yellow-coloured thalli of *Lecideæ*. A. L. S.

Mechanical Action of Corticolous Lichens.—E. Jennie Fry (*Ann. Bot.*, 1926, **40**, 397–417, 35 text-figs.). E. Fry has experimented with corticolous lichens, and their effect on the bark. In no case did she find any of the hyphæ penetrating the cell-walls of the periderm. Her methods of preparing the material, sectioning and staining are described. She found that under the reproductive bodies there was an arching of the periderm immediately below, but no chemical alteration of the cork. The arching is caused by the swelling of the gelatinous tissues of the fruiting organs due to excessive moisture and is the result of mechanical action. To prove this experiments were made with gelatin and rubber in lieu of periderm: reproductive bodies were made to adhere to the rubber, and these when wetted, swelled and caused an arching of the rubber. Elevation of the periderm was found to occur also below the thalline areolæ in certain lichens: it depends on the nature of the thallus and not on its thickness. The effect is caused by the absorption and subsequent loss of water by the lichen tissues. The arching is less pronounced below the thallus than below the reproductive bodies, these being more gelatinous. A. L. S.

Stereocaulon tirolense an Autonomous Species.—E. Bachmann ("*Stereocladium tirolense* Nyl. eine selbständige Stereocaulonspezies," *Hedwigia*, 1926, **64**, 157–62, 8 text-figs.). The above species, a small plant, was named by Arnold *Stereocaulon alpinum*. Bachmann gives a detailed account of the anatomy and development of the lichen, and thus proves that it is a true species and not a form. The podetia may be naked or may bear side branches with sorediate tips. While the sterile podetia reach only a height of 2–3 mm. the fertile are about 11 mm. high and bear dark brown apothecia. A. L. S.

Contributions to Lichen Systematy.—Johannes Hillmann ("Beiträge zur Systematik der Flechten," *Ann. Mycol.*, 1926, **24**, 138–44). Hillmann here discusses the classification and distribution of

Parmelia incurva (Pers. 1794) Fr. (*Parmelia multifida* (Dicks 1793) A. L. Sm.). It grows on granite and is of wide-spread occurrence in northern regions. The second species, *P. centrifuga*, is also a northern plant, which has several times been confused with the commoner *P. conspersa*, and was so confused by early British lichenologists.

A. L. S.

Stereocaulon in Scandinavia.—A. H. Magnusson ("Studies on Boreal *Stereocaula*," *Goteb. Kungl. Vetensk. och Vitterh.-Samh. Handl.*, 1926. **30**, N. 7, 1-89). In the introduction Magnusson gives an account of the different herbaria examined and of the collections made by himself or placed at his disposal by other workers. There follows a careful account of the anatomy of the whole vegetative structure, of the fruiting bodies and of the cephalodia. The latter structures he considers of great taxonomic value owing to the difference in the type of alga they enclose. Distribution and taxonomy are also discussed. In the systematic portion of the paper 23 species are fully described and their varieties and forms delimited. They are northern plants, many of them circumpolar, but they are not infrequent in more southern countries, especially in the more hilly regions. A. L. S.

Lichens from Bear Island (Bjørnøya).—Bernt Lynge (*Resultater Norske Stats. Spitsb. Eksped.*, 1926, **1**, N. 9, 1-78, 1 map, 2 pls.). Lynge has given us in this work an account of lichens collected at various times on Bear Island. He has included in the authoritative and descriptive lists only such plants as he himself has passed under review. He enumerates 185 species, a large number for a small area, but he thinks there must be many more not yet recorded. Lynge finds that lichens are either entirely adapted to arctic conditions and develop well, or they are injured by the climate and present a very poor appearance. Soredia and isidia are very poorly developed, but in all the fructification is normal and healthy and the chemical reactions true to type. In the systematic section several new species are described in the genus *Lecidea*, as well as new forms, and there are many biological and systematic notes. A. L. S.

New or Interesting Swedish Lichens: III.—A. H. Magnusson (*Bot. Not.*, 1926, 227-37). Magnusson has described a number of new crustaceous lichens collected by himself or others. He gives also a number of new localities for some of the rare *Acarospora* species.

A. L. S.

Lichenological Notes: XXII.—Bouly de Lesdain ("Notes Lichénologiques XXII.," *Paris, Bul. soc. bot.*, 1925, Sér. 5, **1**, 787-91). Descriptions of a varied series of new species with full microscopic details. They are mostly Mediterranean plants from Southern Europe or from North Africa. A. L. S.

Lichens of Morocco.—Bouly de Lesdain ("Lichens du Maroc recueillis par M. Mouret en 1912," *Mém. Soc. Hist. Nat. Maroc*, 1926, **8**, 290-9). A series of lichens from trees, soil or rocks, important as to locality. References and localities are given. In the case of new species the microscopic descriptions are full and clear. A. L. S.

Carpathian Lichens.—JINDRICH SUZA ("Lisejniky Podkarpalské Rusi," *Zoláštni ot. ze Sborn. Přirod. Společ.*, 1924–5, **3**, 1–20; Slovakian, with Ecological Notes in German). The lichens here enumerated are from the Russian Carpathians. The inorganic substratum is of Carpathian sandstone, with a less conspicuous lichen flora than on the granite or limestone of the High Tatra. He enumerates the species on the sandstone, a few species on moss clumps, and still other types on the moss cushions that were living in clefts of the stone. Above the forest region on humous soil numbers of *Cladoniæ* and *Cetrariæ* were recorded. In the woods, especially in virgin forests, there was a great development of large foliose *Parmeliæ* and *Cetrariæ*. Among the lichens that inhabit the districts with excessive moisture he lists—*Usnea longissima*, *Alectoria thrausta*, *Cetraria complicata*, *Parmelia sinuosa*, etc. Another characteristic flora inhabited dead stems, mostly *Cladoniæ*. Records are also given of lichens on various trees—pines, beech, rhododendron, etc.

A. L. S.

Mycetozoa.

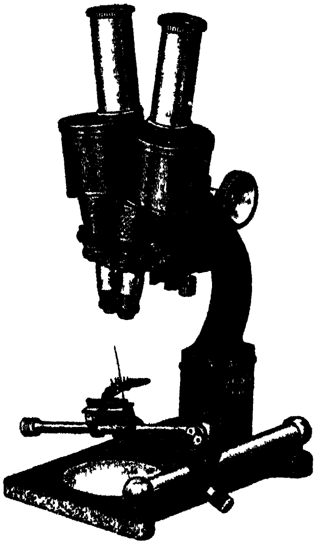
Mycetozoa in Polynesian Mycology.—THOMAS H. MACBRIDE ("Bit of Polynesian Mycology," *Mycologia*, 1926, **18**, 125–31). Macbride bases his statements on two consignments of Mycetozoa from Polynesia. The species he records are of wide distribution, and as an explanation he suggests that the introduction of alien plants which has been of constant occurrence for many years may have carried spores with them. Thus, for instance, in New Zealand there has been an importation of Californian *Pinus radiata* for the reforestation of wide areas. The species from those distant countries sent to Macbride have been examined, and notes are given as to any changes discernible. Twenty-four species from New Zealand are thus discussed, and two from Suva; finally, three species of micro-fungi that are mimic forms. A. L. S.

MICROSCOPY.

B. Technique.

Device for Examining Transfixed Insects.—For the purpose of viewing small insects, flowers and similar objects without trouble under magnifying lenses of considerable power, the earliest microscopists were prompted to devise object holders resembling an engineer's drawing pen. In these the object which is to be examined is clamped between the two blades and then directed into the desired position. Later, especially for viewing insects, devices of this kind were provided with ball-and-socket joints and an attachment to which the insects could be secured with needles passed through them, and could thus be turned in various directions so as to present any particular part of the body of the insect to the viewing lens. Devices of this kind are still in use, but they have the great disadvantage that the position of the transfixing needle requires to be frequently changed. This in its turn necessitates much re-focussing, whereas it is of the utmost importance for the proper interpretation of certain features, especially moulded details, that with the least possible incidental delay the object should be capable of being viewed from all sides under a gradually increasing angle of incidence while remaining in focus; or, for the purpose of making a drawing, it is essential that it should be capable of being fixed in that best position which can only be ascertained under rather high magnifications. (For instance, to estimate relative lengths of the articulations of the antennæ and legs, which when dry are usually curved, it may be required to orientate these in a horizontal plane.)

An apparatus devised by Dr. Karl Heller, which completely satisfies the above requirements, has been further developed by Messrs. Carl Zeiss, Jena, with a special view to its convenient use on a binocular microscope. It consists of an iron plate upon which any of the Zeiss binocular microscopes may be screwed by its upper body. This plate has a central circular recess to accommodate various black or white glass or cork discs, and at its left side is fitted a guide rod which carries an object holder capable of moving in all directions about a ball-and-socket joint. This object holder is clamped to the rod by a spring clip. The object holder provides such varied possibilities of attaching the insect by the point of the pin or clamping it to the head of the pin, that every part of the insect's body may be brought into view without difficulty. A hinged device provides a means of presenting the sides of the insect, which is often desirable in the case of large insects. Moreover, the object holder as a whole can be readily displaced in a backward and forward direction along the guide rod, which is a distinct advantage when large surfaces, such as butterfly's wings,



are to be examined. The manipulation of the apparatus, after affixing the insect, consists in the main in moving the object holder with the right hand and the pinion head of the binocular with the left hand in such a manner that the object may remain in permanent focus. No one accustomed to its use would care to be without it. The English distributing agents of Messrs. Carl Zeiss, who have now standardized the manufacture of this accessory, are Messrs. J. W. Atha & Co., Winsley House, Wells Street, Oxford Street, W.1

LEATHER INDUSTRY.

Micro-Tannology.—G. D. McLaughin and F. O'Flaherty (*Journ. Amer. Leather Chem. Assoc.*, 1926, **21**, 338–51). Micro-tannology is the term given by the authors indicating the application of the microscope to the science of tanning. The present article includes an outline of cell structure and reproduction. Tissue structure is also dealt with. Twenty figures are included in the text. A. H.

Aspergillus niger. A common Mould that causes Black Spots on Leather.—J. A. Wilson and G. Daub (*Journ. Amer. Leather Chem. Assoc.*, 1925, 400). The authors trace the formation of black spots on leather to the infection by *Aspergillus niger*. The life-history of the mould is described, and several micro-photographs are included. The mould grows well in an acid medium, and leather dipped in 1·5 normal acid showed growths after standing for a time. Growths did not occur when 2 p.c. normal acid was employed. Caustic soda solution inhibits growth. The mould penetrates the leather fibres during growth. and its removal from leather is difficult. A solution of chlorine water 1:50,000 was an effective disinfectant, and less satisfactory results were obtained with formalin and mercuric chloride. Disinfection of storage rooms is advocated, and a dry atmosphere is essential. A. H.

NOTICES OF NEW BOOKS.

The Melanomata: their Morphology and Histogenesis. A study of cell origins and transformations, with a critical discussion on aspects of tumour growth and a clinical review. By James W. Dawson. Edinburgh: Oliver and Boyd. 1925. Large 8vo, pp. xii and 224, 40 text-figures and 26 plates, 4 in colour. 12*s.* 6*d.*

This volume is a reprint in monograph form of last October's number of the "Edinburgh Medical Journal" in which the pagination of the original publication is retained. It constitutes a very detailed study of the cutaneous and ocular pigmented new growths, and is profusely illustrated by drawings of tumours by John Greeve, black and white text illustrations by Mrs. Dawson and four coloured plates by the same artist, which for technical fidelity and artistic beauty could not be surpassed; also a series of excellent photomicrographs by Thomas Hamilton, F.R.M.S.

The author has grouped his subject-matter under five headings, of which Part I. forms an introduction in which the scope of the investigation is discussed, together with the material available and the details of the methods employed, and the historical aspects of the subject. Part II. details the histological study of the benign melanomata of the skin (including pigmented nævi), the malignant melanomata of various tissues, and the transitional types together with the several changes they undergo. Part III. correlates the clinical study with histological data, and includes a general classification. Part IV. : A critical discussion dealing with the origin and function of pigment and the etiological considerations, including the relationship of melanomata to cell rests, etc., and their response to chemical and other irritants; concluding with Part V., in which the author formulates his deductions from the clinical and histological data.

An excellent bibliography occupying seven pages is appended; an index is lacking, but this omission is compensated for to some extent by the tabular synopsis of " Contents " and Index to Illustrations.

The main conclusions arrived at are that melanin is metabolized from a colourless chromagen by the action of a specific oxydase found only in the melanoblast—the true pigment-forming cell of the skin (of basal epithelial origin)—but that mesoblastic chromatophores are incapable of forming pigment, although ready to take up melanin granules shed from the melanoblasts; that all cutaneous malignant melanomata are of epithelial origin; that choroidal melanomata are of neuro-epithelial origin; and that melanomata of other sites arise from primitive ectodermal cells of a migratory type. But the monograph must be read *in extenso* to fully appreciate the patient and laborious research which has resulted in the accumulation of such an immense store of information. Whilst the great appeal of the work is to the morbid histologist and the pathologist, the surgeon and also the practitioner will welcome its appearance as a notable exposition of a fascinating subject.

J. E.

Die Verwendung des Polarisationsmikroskops für biologische Untersuchungen. By Prof. Dr. A. Köhler. Jena: Urban und Schwarzenberg. 1926. Pp. 202, 113 figs.

This work, in reality, is a section (*Lieferung*, 191) of a full and comprehensive treatise on Methods of Biological Work. As its name implies, it deals with certain physical methods of operation. It is divided into nine chapters, each of which describes the principles of a number of standard investigations (*Versuche*) by means of polarizing apparatus. The titles of a few of the chapters will illustrate the treatment of the subject:—(i) Übersicht über die polarisationsinstrumente für das Mikroskop und ihren Einflusz auf die Abbildung; 2 *Versuche*: (iii) Die mikroskopische (orthoskopische) Untersuchung in polarisiertem Licht; 39 *Versuche*: (v) Die Bestimmung der Brechzahlen unter dem Mikroskop; 5 *Versuche*: (viii) Das optische Verhalten halbisotroper oder Kristallinischer Objekte Eigendoppelbrechung und

Stäbchendoppelbrechung; 10 *Versuche*. The details are handled in a very thorough manner. The investigator is instructed how to arrange his apparatus, what to look for, and how to interpret his observations. The Table of Contents and the Index of Subjects are given in a previous *Lieferung*. A. N. D.

Probleme der Atomdynamik. By Professor Max Born. Julius Springer, Berlin. 1926. Pp. 183 + viii. 12*s*. 6*d*.

Some apology may seem needed in drawing the attention of readers of the Journal to a book that in title at least, suggests aims somewhat remote from those of the average microscopist. We should miss, however, a golden opportunity if such considerations deterred us, for in this volume Professor Born collects a series of thirty lectures delivered in America during the academic year 1925–26 on the quantum theory of the atom and the most recent advances in our knowledge of the crystalline state. For the present purpose reference will be limited to the latter subject.

Lectures 7, 8 and 9 of Part II. are those in which mineralogists should revel. The main theme throughout is the profound question as to why it is that certain natural (and artificial) compounds crystallize as they do, in a number of different classes and habits. The criterion is shown to be stability, from the energy standpoint. According to the energetics of the system, diagonal, molecular, radicle, or "stratified" lattices are formed, some of these only being arrived at by virtue of the fact that their constituent ions are not rigid. Allotropic forms such as rutile and anatase, wurtzite and zincblende are discussed, and in the former case the energies are found to be approximately the same, explaining the fact that both those varieties of titanium oxide occur in nature to nearly an equal extent. Many other instances of interest to the physical microscopist are reviewed in the light of modern knowledge.

The author has the invaluable gift of ready exposition; the reader, however, must expect to meet a certain amount of heavy weather before he makes harbour, though the lecturer (for the original lecture form is retained) is so careful, so patient of his hearer's infirmities, that a "transport of delight" is made as certain as anything can be, and not to read this book would be an omission hard to repair.

The publishers deserve every credit (in spite of two slight misprints, p. 8, equation (2), and p. 128, equation (2)) in producing a volume worthy of such a subject, and in presenting it in such form as the audiences in Massachusetts were privileged to hear. F. I. G. R.

The Cancer Review. A Journal of Abstracts. Issued under the direction of the British Empire Cancer Campaign, 19 Berkeley Street, London, W.1. 1926. Vol. 1, No. 1. Subscription 30*s*. per annum.

An Introduction to Experimental Embryology. By G. R. de Beer, M.A., B.Sc., F.L.S. 1926. 148 pp., 51 figs. Printed at the Oxford University Press.

PROCEEDINGS OF THE SOCIETY.

AN ORDINARY MEETING

of the Society was held at 20 Hanover Square, W.1, on Wednesday, June 2nd, 1926, Dr. James A. Murray, President, in the Chair.

The Minutes of the preceding Meeting were read, confirmed, and signed by the Chairman.

The nomination papers were read of two Candidates for Fellowship.

New Fellows.—The following were elected Ordinary Fellows of the Society:—

G. P. Bidder, M.A., Sc.D.
W. Knibb Burford.
J. S. Cockrill.
H. Delisle.

Donations were reported from:—

Señor B. Caballero—
"Tecnica de las Preparaciones Microscopicas Sistematicas."
Mr. D. J. Scourfield—
"*Lepidocaris Rhyniensis.*"

A hearty vote of thanks was accorded to the donors

The following papers were read in title:—

Miss Evelyn E. Hewer, D.Sc.—
"Effect of Fixative on Staining Reaction."
Mr. C. H. Oakden—
"Joseph Bancroft Reade: His Contributions to Microscopical Science."

THE ANNUAL POND-LIFE AND GENERAL MICROSCOPICAL EXHIBITION.

The following objects were exhibited by Fellows of the Society and Members of the Quekett Microscopical Club:—

Mr. F. Addey	Circulation in Frog's Foot.
Mr. S. C. Akehurst, F.R.M.S.	*Fredericella sultana.*
Dr. E. W. Bowell, F.R.M.S.	Radulæ of *Physa.*
Mr. C. H. Caffyn, F.R.M.S.	Various Rotifers: *Anuræa aculeata*, *A. cochlearis*, *Triarthra longiseta*, etc.

Mr. C. Campbell	*Vorticella* sp.
Mr. E. Cuzner, F.R.M.S.	*Acanthocystis turfacea* and *Floscularia* sp.
Mr. M. T. Denne, F.R.M.S.	Medusa (*Oceania pileata*).
Mr. E. H. Ellis, F.R.M.S.	*Entophlyctis bulligera*: a fungus disease in *Spirogyra*.
Prof. R. Ruggles Gates, F.R.M.S., and Mr. W. R. I. Cook	Fungus diseases of Water-plants.
Mr. F. B. Gibbard	*Arrhenurus albator*.
Mr. A. Morley Jones	Rare species of Diatomaceæ from the Barbados deposit.
Mr. H. J. Lawrence	*Lophopus crystallinus*.
Mr. D. Macdonald	*Chydorus sphæricus*.
Mr. E. R. Martin	Various Water-Mites (*Limnesia*, *Piona*, *Arrhenurus*).
Mr. E. K. Maxwell, F.R.M.S.	*Stephanoceros eichhornii*, *Melicerta ringens*, *Oecistes longicornis*.
Dr. J. A. Murray, F.R.S., F.R.M.S.	*Euglena* sp.: encysted, dividing and flagellate forms. *Acarus* from mouse.
Mr. C. H. Oakden, F.R.M.S.	Various Water-Mites (*Diplodontus despiciens*), etc.
Mr. J. M. Offord, F.R.M.S.	*Hydrodictyon reticulatum*.
Mr. J. Richardson F.R.M.S.	*Synedra splendens* on *Lemna*.
Mr. W. N. Scott	*Micrasterias denticulata*.
Mr. D. J. Scourfield, F.R.M.S.	*Asellus meridianus* and *A. aquaticus* (young specimens), showing characteristic pigment patterns on head.
Mr. B. J. Thomas	*Draparnaldia plumosa*.
Dr. C. Tierney, F.R.M.S.	*Cristatella mucedo* (young recently hatched from statoblasts).
Mr. W. R. Traviss, F.R.M.S.	Various Rotifers and *Carchesium* sp.
Mr. J. Wilson, F.R.M.S.	Oospores of *Volvox globator* and various Desmids (*Hyalotheca dissiliens*, *Closterium juncidum*, *Staurastrum furcigerum*, *Xanthidium antilopæum*, etc.

Mr. Scourfield, being called upon by the President to make some remarks about the exhibits, said that although it was obvious that the Royal Microscopical Society could not limit itself to any one branch of microscopy, he thought the Council had acted wisely in allowing, as it had done for many years past, one meeting in the year to be devoted mainly to an exhibition of pond-life. This encouragement of the study of living aquatic organisms was certainly justified. There was a distinct danger that the fascination exercised over many minds by the wonderful modern methods of the laboratory for preserving, sectioning and staining organisms might prevent proper attention being given to the organisms while they were alive. The study of pond-life was, or might be, an excellent corrective to this tendency. Another justification for paying special attention to pond-life organisms was the wide circle to whom they could be made to appeal. From the most dilettante amateur microscopist to the ultra-professional biologist—there was something for them all. To the amateur who used his instrument avowedly solely for recreation, living organisms from our lakes, ponds and ditches could always be relied upon to give the maximum of pleasure for the minimum of trouble. The surpassing beauty of many of them was a sheer delight to behold, and the person who could look at them without being haunted by the specialist's torments as to the correct identification of the species, and so on, was in many ways to be envied. On the other hand, to the specialist and professional biologist the problems of fresh-water biology were as important and far-reaching as those of any other branch of biology, and the comparative ease with which fresh-water organisms could be collected, cultivated and experimented with was a powerful additional argument in their favour.

Mr. Scourfield then referred in some detail to the various exhibits, calling particular attention to *Hydrodictyon* (the "Water-net"); *Volvox globator*, with its characteristic stallate oospores; the encysted *Euglenæ*; the fungus diseases of water-plants; *Acanthocystis turfacea*, with its bifurcated spines; *Triarthra longiseta*, with its "skipping" spines; the young specimens of *Cristatella*; *Chydorus sphæricus*, probably the most abundant and most widely distributed of all the Entomostraca; and *Asellus meridianus*, a species only recently recognized as distinct from *A. aquaticus*, with its characteristic pigment pattern on the head.

On the motion of the **President**, a hearty vote of thanks was accorded to the Members of the Quekett Microscopical Club and to the Fellows of the Royal Microscopical Society who had kindly exhibited specimens, and also to Mr. Scourfield for his remarks.

The business proceedings then terminated.

JOURNAL
OF THE
ROYAL MICROSCOPICAL SOCIETY.
DECEMBER, 1926.

TRANSACTIONS OF THE SOCIETY.

XVI.—CONTRIBUTIONS TO THE STUDY OF THE FILTERABLE VIRUSES.

(*Read April* 21, 1926.)

A.—*Bovine Pleuro-Pneumonia.*

By Joseph E. Barnard, F.R.S., F.R.M.S.

The organism which is regarded as the causative agent of this disease is, from a morphological standpoint, one of the most interesting known to bacteriological science. It is interesting, not only because of its peculiar structural characteristics, but also because it appears to be a connecting link between ordinary bacteria and those known as filterable viruses or "filter passers." There is no need to give any description of the group of organisms known as bacteria, but some few remarks on filter passers, large as the literature of the subject already is, may be of interest to this Society. Strictly speaking, no organism in this group has yet been observed with sufficient accuracy and certainty as to enable an exact description to be given of either its morphological or cultural characteristics. Further, even a definition of what is meant by a "filter passer" is difficult, if not impossible, as no method of standardizing filters in quantitative terms has yet been evolved; in fact, most bacteriologists show no great anxiety to find such a standard—they seem to prefer the uncertainties of the present situation. It is now nearly thirty years ago since Loeffler and Frosch found that the virus of foot-and-mouth disease would pass through a Berkefeld filter which would hold back any so-called ordinary organisms. Since that time, a considerable number of causative agents of other diseases have been found to behave in a organisms while they were alive. The study of pond-life was, or might be, an excellent corrective to this tendency. Another justification for paying special attention to pond-life organisms was the wide circle to whom they could be made to appeal. From the most dilettante amateur microscopist to the ultra-professional biologist —there was something for them all. To the amateur who used his instrument avowedly solely for recreation, living organisms from our lakes, ponds and ditches could always be relied upon to give the maximum of pleasure for the minimum of trouble. The surpassing beauty of many of them was a sheer delight to behold, and the person who could look at them without being haunted by the specialist's torments as to the correct identification of the species, and so on, was in many ways to be envied. On the other hand, to the specialist and professional biologist the problems of fresh-water biology were as important and far-reaching as those of any other branch of biology, and the comparative ease with which fresh-water organisms could be collected, cultivated and experimented with was a powerful additional argument in their favour.

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There are three directions in which research can proceed in the investigation of the problems connected with filterable viruses:—

By filtration processes.
By centrifuging any infective material.
By microscopical observation.

Filtration methods are, as already mentioned, the basis of classification. If it were possible to conduct filtration experiments on the simple lines that might at first glance be expected, then all the problems associated with such small bodies would be simplified. Unfortunately filtration is not merely a process of sifting, of allowing particles to pass or not pass through a mesh of mechanically exact size. Even in sifting the coarsest materials, such as sand, it is necessary to get rid of the coarse residuum at frequent intervals, but fine filtration methods do not provide for this. A filter is expected to perform for some time, and to deal with a fluid in one continuous operation until a given amount of material has been passed through. The result is that in all such experiments the filter is steadily and often rapidly becoming less porous. This obvious defect it is hoped will be removed by a device at present under test. Still filtration must even at its best remain somewhat uncertain, as few organic fluids are simple suspensions; they contain particulate bodies with widely varying physical characteristics. No better example of this can be shown than the organism of bovine pleuro-pneumonia, which, as Mr. Smiles will tell you, has widely varying phases, the small granular form being associated with other bodies of an essentially different physical character. Briefly the main points of difference are the following:—

Some are less resistant to heat than ordinary bacteria, while their resistance to the action of some other reagents, such as glycerine, is greater. They are all apparently difficult to grow in artificial culture. This difficulty may arise not from any inherent inability to reproduce themselves under such circumstances, but to their being less able to tolerate a departure from the conditions of their normal habitat. They would appear, therefore, to be more strictly parasitic than ordinary bacteria. They are all invisible, or at least unresolvable by ordinary methods of microscopical observation. This may be due either to smallness or to lack of optical contrast between the organisms and their surroundings.

We may therefore regard the chief characteristics of filterable viruses to be their ability to pass through a filter which holds back all ordinary organisms. The test of this should be that the filtrate contains no visible organisms as shown by microscopical examination, or by cultural tests. Bacillus prodigiosus is a typical example of an organism that, although it is a cocco-bacillus of very small size, will not go through a porcelain filter which easily passes any known filterable virus. The filtrate should possess the property of producing disease in the same way that the unfiltered material does. Several disease-producing viruses satisfy this test, but it must be admitted that the further knowledge gained has not been great, and much remains to be done to put the subject on a sure foundation. To this Society the chief interest is microscopical, and in this direction it is true to say that all orthodox methods have failed. Staining processes have been tried to the utmost, but it is quite evident that if we are dealing with bodies that are smaller than the resolution limits of any optical system used under ordinary conditions, no result of value is to be expected. It matters little in fact what colour a body is if the microscope cannot form of it a recognizable image. In most of the staining methods used the purpose has been to increase the apparent size as well as the visibility of the organism. Thus the result obtained is in reality due to a process of deposition, and it is difficult to see how such an artificially enlarged object can give a recognizable characteristic image. Further, even colour differences are not appreciated under such circumstances, as the image obtained is almost entirely due to diffraction, and as such has optical qualities independent of any colour imparted to the object itself. All ordinary bacteria may be stained, and their size and form demonstrated if they are not less than $0 \cdot 2\ \mu$ in diameter. To show satisfactorily an organism of this size, the best available objectives must be used under perfect conditions of illumination, a state of affairs rarely realized completely. The organism of bovine pleuro-pneumonia, at least in some of its cultural phases, comes within this limit, and so is just resolvable in stained preparations, although the most interesting phases of its life cycle are not shown. It therefore appeared that any observations to be of value must be made on the living organism, and for this purpose use has been made of a dark-ground illuminator made by R. & J. Beck, Ltd., and an objective of 1·2 N.A. Another illuminator which allows of the use of an objective of 1·27 N.A. has also been used, and this represents the highest attainable N.A. for observing an organism in a medium of approximately the same refractive index as water.

Filtration experiments do not come within the province of microscopy in any general sense, but the problem under consideration had to be considered from all sides. The question of the size of the organism and some of its physical characteristics could be answered in large part by accurate filtration. An investigation is in progress on the permeability of collodion membranes as devised by Bechhold, particularly in reference to these organisms, and to other investigations on filterable viruses.

Centrifuging is no more certain in its effects, although the results are obtained more easily. Again, the position would be simplified if we were dealing with uniform suspensions in fluids of constant specific gravity, or of constant viscosity. In such cases results might be obtained with certainty, and the known physical formulæ for deducing the size of deposited particles could be applied. This, however, is difficult in practice with small living organisms of the filterable virus type, of which pleuro-pneumonia is an example, in which variability of form occurs so largely as to be characteristic. As mechanical contrivances centrifuges are far from perfect, and with most laboratory types it is difficult and often impossible to repeat accurately an experiment. This again is a problem needing investigation with improved methods. Microscopically, the problem can only be attacked by two methods, the use of high-angled dark-ground illuminators, or by means of light of short wave-length. The former gives us the necessary visibility, but the latter when it is developed to its full possibilities will be equal to any demand made, even by the smallest of filterable viruses. The ideal position will in fact only be reached when we can by filtration or centrifugalization determine the size of body under investigation, and then apply the necessary radiation of suitable wave-length to secure microscopical resolution. Physical developments are such that the radiations can be produced; it remains for us microscopists to find out how to use them.

It is hardly possible to conclude even this incomplete account of filterable viruses without reference to the possibility that they are not of the nature of living organisms at all. That there are great differences between the two groups already referred to is certain; but are they fundamental differences or only those arising from the physical reduction in size? It would not be difficult to throw out suggestions indicating that we were at the boundary line between the living and non-living, whatever the exact meaning of those terms may be. I have no intention of attempting such a task here, although it does appear to me to be a suitable and even exciting subject for anyone possessed of the necessary knowledge and scientific imagination. It is suggested by some that enzymes or ferments may produce the observed results, but this appears to be merely exchanging one obscurity for another. The exact constitution of enzymes is still unknown, although they appear to be in the colloidal state and therefore particulate. They are sensitive to change of hydrogen-ion concentration, and also to change of temperature, as are filterable viruses. The extraordinary series of phenomena associated with the bacteriophage also present problems which are explained on the basis of a living unit, but may be equally well explained in terms of enzyme action. A living unit, the diameter of which is less than 0·1 micron, is likely to have a cell wall of no greater thickness than that to be attributed to the result of surface tension. In such a small body surface tension is probably very great, although our knowledge of the physical conditions in such cases is so limited as to leave a wide field for speculation.

The two succeeding papers by my colleagues, Smiles and Welch, represent in one case a series of observations on cultures of bovine pleuro-pneumonia, and in the other a description of a culture method that has proved of considerable value in observing small early colonies of any organisms that can at present be grown artificially. Both investigations are connected with work in progress on filterable viruses.

B.—*The Morphology of Bovine Pleuro-Pneumonia.*

By John Smiles, A.R.C.S., F.R.M.S.

Five Text-Figures.

In the following description of the morphology of bovine pleuro-pneumonia, the principal features described are those which occur between the time of inoculation of a fluid culture medium, and the subsequent clouding of the medium due to the growth of the organism. This clouding or opalescence occurs after about three or four days' incubation.

The primary cultures, upon which the experiments to be described were carried out, were obtained in the first place from the Pasteur Institute, Paris, through the kind influence of Capt. S. R. Douglas, F.R.S.

It is difficult to obtain such material in this country owing to the restrictions imposed by the Board of Agriculture. Further, it is not possible to verify by experiments upon animals the virulence of these cultures for the same reason. It is, however, almost certain that any artificial cultures of these organisms retain their virulence for but a short time—probably only for a few hours. As, however, the general microscopical appearances agree with those of at least two other Continental workers, who have had virulent material at their command, it is fair to assume that the organism is, in fact, the one here described.

The microscopical examination of the cultures was carried out by means of dark-ground illumination, in which a high-angle dark-ground illuminator and an unstopped oil-immersion objective of 2 mm. focal length and 1.20 N.A. were used. For the production of a good dark-ground image it is absolutely necessary that perfect centration of the system be secured.

The method, referred to by F. V. Welch, of obtaining cultures from young colonies has been systematically carried out at short intervals; since many of these colonies must each have developed from a single organism it may be assumed that the cultures used in this work were obtained from a single cell.

When working with cultures in media of varying composition, it was found necessary to examine them before opalescence occurred. It was noticed that the shape, size, and visibility of the organisms changed very considerably with age, and that, so long as the medium did not retard the growth of the organisms, the general characteristics were but slightly affected. We therefore felt that the changes which we were observing were those which took place in the natural process of development, and that the forms observed could not be aberrant ones.

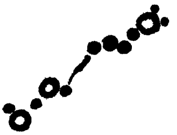

Fig. 1a.

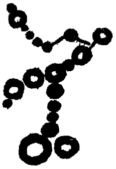

Fig. 1b.

The procedure followed in studying the life cycle was to inoculate serum agar slopes, seal the ends of the tubes with wax to prevent evaporation of moisture, and to incubate at 37° C. for four days. From these cultures, tubes containing horse serum broth (PH = 7·6) were then inoculated, and incubated aerobically at the same temperature. After about 16 hours' incubation these cultures were examined microscopically, and then at intervals of 24 hours, or thereabouts, until the medium became opalescent.

The following is a typical example of the observations made. Figs. 1*a* and 1*b* show diagrammatically the forms of organisms, which were scraped from the surface of solid medium, and with which the fluid media were inoculated. The groupings are of interest since there is a close resemblance to those found in fluid cultures.

The first examination of the fluid cultures was made about 16 hours after inoculation. The material examined was taken from the bottom of the tube, where it was found that the culture was richer.

The outstanding characteristic was the grouping of organisms, rather than their individual forms. The groups, four of which are shown diagrammatically in fig. 2, consisted of chains of organisms so close to one another that it was impossible to detect the way in which they were connected. In other experiments short filaments of low visibility have been observed, while at a later stage filamentous connections can easily be seen.

The forms which an organism may take up during its development may be classified as follows: (1) spherical, (2) aspherical, and (3) granular. The aspherical may be subdivided into two classes: (1) elliptical, and (2) cylindrical.

All forms were of high luminosity, the spherical and aspherical forms being indicated by a thick bright outline, the outer edge of which was diffuse. Within this outline was an area of rather low luminosity. The granular form appeared as a bright disc, also having a distinctly diffuse edge. The number of these forms in each group varied considerably, but isolated organisms were very scarce.

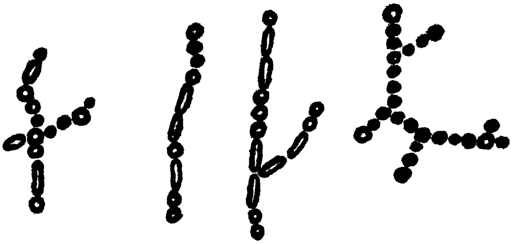

FIG. 2.

In the case of opalescent cultures spherical and granular forms predominate. The former are indicated by a thin, and less bright ring, while the area within this appears as dark as the dark field. The granular forms are also of lower visibility with practically no diffuse edge, giving the impression that they are of small size and near the resolution limit for the objective used.

After 40 hours' incubation the bottom of the tube was again found to be richer in organisms, but to a less marked degree. Grouping of the organisms, which took the form of chains, was still its chief characteristic, but, although the same forms were to be found in the groups, their visibility was not so marked, nor were they so closely held together. Connecting filaments between the organisms could in many cases be clearly seen.

The spherical and aspherical forms were indicated by thinner outlines which enclosed areas of decidedly lower visibility. In both cases the outer edge had lost much of its diffuse character. Many of the cylindrical forms were longer and narrower than those previously observed, while there were numerous short chains similar to those indicated in fig. 3. Other forms and groups which may sometimes be found at this stage are also shown diagramatically.

After a further 24 hours' incubation the medium had become slightly opalescent, and it was found that upper and lower layers of the culture were equally rich in organisms. There was a large decrease in the number of aspherical forms, but those indicated by fig. 5 were plentiful. The groups consisted of only three, or four organisms at most, and these were connected by long filaments of low visibility.

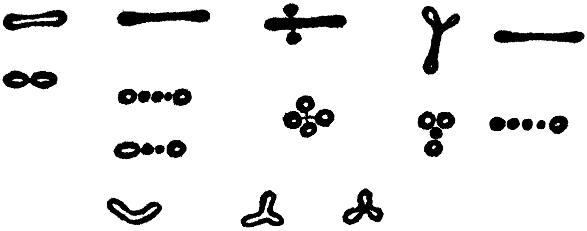

Fig. 3.

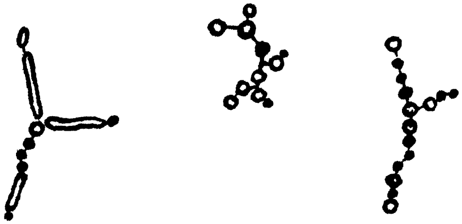

Fig. 4.

Twenty-four hours later, when the medium had become distinctly opalescent, there was a considerable reduction in the number of groups consisting of two and three spheres. The culture chiefly consisted of free granular and spherical forms, but there were a number of spheres with granules closely attached to them, whilst the aspherical form had completely disappeared. There was also a considerable reduction in the brightness of the forms present compared with that of the organisms in younger cultures."

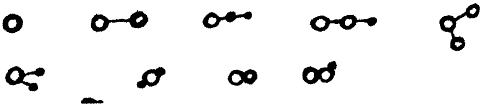

Fig. 5.

The above is a description of what is usually observed during the growth of cultures prepared in the way described. Since a very large number of these cultures have been examined, the following deductions may be made.

1. The forms which the organisms take in the early stages of growth may be classified as follows:—

(*a*) Spherical forms
(*b*) Aspherical forms
    (i) Elliptical forms
    (ii) Cylindrical forms
(*c*) Granular forms.

2. Grouping of the organisms is the principal feature of a young culture—the occurrence of any one of the above forms singly being purely accidental. As the culture ages the number of organisms per group diminishes. Finally, the culture becomes opalescent when the culture consists of single spheres with closely attached granules, single spheres, and single granules.

3. The life cycle may be regarded as commencing from any one of the above forms. For example, the spherical form becomes elongated, resulting in the form (*b*) (i). This elongation continues until the cylindrical form is reached. This form breaks up into two, or three small spherical, or granular forms, the latter developing into spherical forms. After 48 hours' incubation the cylindrical form may break up into a chain of four, or even five granules each developing, on further incubation, into the spherical form, thus forming a chain of spheres.

4. As the age of the culture increases there is a diminution in the visibility of the organisms.

Subcultures were also made from fluid cultures, and examined in the same way. Fig. 4 shows the grouping of organisms which occurs at the same stage as those shown in fig. 2. The filaments connecting the various forms were much more evident, and the tendency was for the organisms to be of lower visibility. In general, however, the characteristics of these cultures were very similar to those already described.

C.—*A New Method of Cultivating Micro-organisms.*

By Frank V. Welch, F.R.M.S.

One Plate.

The ordinary method of growing micro-organisms in colonies admits of satisfactory observation only if the colonies are large enough to be seen and examined without the aid of a microscope. The method here described was primarily devised to enable colonies of bovine pleuro-pneumonia of small size to be found and their characteristics observed *in situ* even with a 1/12th inch oil-immersion objective. Colonies on serum-agar are firmly attached to the medium and are too old for satisfactory examination by the time they are visible to the naked eye. The orthodox method of making impression preparations is rarely successful, and in any case only a portion of the colony adheres to the cover-glass. The usual staining methods are unsatisfactory, the chief characteristics being shown either very indistinctly or not at all. A preparation (fig. 3) was made by spreading a loopful of condensation water from a serum-agar culture on a slide. After drying in air the film was fixed in alcohol and ether and stained in dilute carbol fuchsin for ten minutes. The appearance suggests some of the forms described by Mr. Smiles and others, but it would be difficult to arrive at any conclusion without further controlling methods of observation. Fluid cultures of the organism, e.g. in serum broth, may be examined by the dark-ground method, but are difficult to photograph. Unless the organisms settle on the slide and remain more or less immobile, little can be done to obtain a satisfactory image. Further, the spheroidal forms become distorted when they come in contact with slide or cover-glass, thus rendering observations valueless. The only method that has in my hands been fairly satisfactory is to coat the slide with a very thin layer of gelatine before making the preparation. Thus the form of the organism is sometimes preserved, but the method is too uncertain for general use.

To overcome these difficulties the following method was devised, which we refer to as the "slip method." We take a test tube 7 in. by 1 in. (fig. 1), and put into it three strips of glass arranged in the form of a triangle. The pieces of glass thus support each other. Nutrient agar is then put into the tube up to the level shown, the tube plugged with cotton wool, and the whole is then sterilized. Before inoculation the tube is placed in boiling water until the agar melts. Agar medium melts at 98° C., but has the

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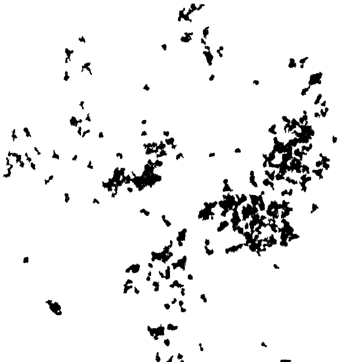

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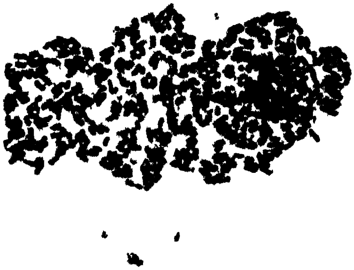

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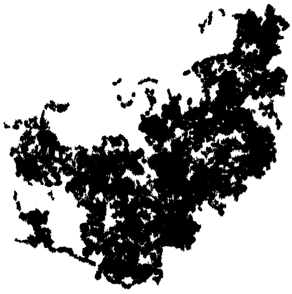

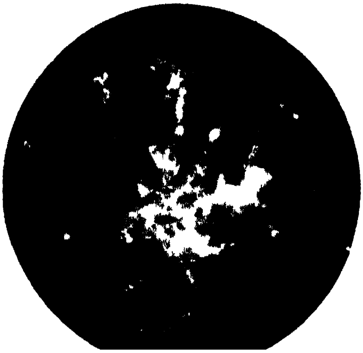

useful characteristic of remaining fluid until the temperature falls to 40° C. It is thus possible, and convenient, to inoculate the medium while it is still fluid, and yet for it to be sufficiently cool to do no damage to the organism inoculated. The tube, then, is boiled until the agar melts, and is allowed to cool—still in the water bath—until the temperature falls to about 50° C. If it is desired to add serum to the agar, a tube containing the requisite amount of serum is then placed in the water bath so that serum and agar may attain the same temperature. The serum is now added to the agar and the agar tube rotated between the hands to secure efficient mixing. The tube is then inoculated, again rotated, and is gently tilted so that the medium flows up and down each of the strips of glass. This is repeated three or four times and the tube is placed in a vertical position in a vessel of cold water to set. When the agar has solidified, a rubber cap is placed over the mouth of the tube to prevent evaporation during incubation. An additional safeguard against evaporation is to add glycerine to the culture medium in the proportion of 5 p.c., although as a matter of fact very little drying appears to take place. When it is desired to examine one of these slips it is withdrawn from the tube with sterile forceps, and a cover-glass is placed on the agar layer: there is always sufficient moisture present to act as a mounting medium. The cover-glass is luted with melted paraffin wax, and the slip is then ready for examination except that there is a layer of agar on all surfaces of the glass. The back and edges of the slip are cleaned off with a pledget of damp cotton wool, and the slip is put on the stage of the microscope. The layer of agar is thinner at the upper end of the slip, consequently the concentration of colonies is greater at the lower end. If when examining a slip the colonies are found to be too close together to allow of accurate observation, one merely moves along towards the other end. It is of course as easy to grow on quartz as on glass. The only difference is that the quartz slips are smaller and have to be suitably supported on glass. Thickness of agar layer depends on the temperature when coating the slide, and on the number of times the tube is tilted.

Before we finally adopted this method one or two points had to be determined. The layer of agar medium remaining on the glass slips has to be very thin, and we were doubtful whether there would be sufficient nutritive material to support growth until a colony of reasonable size could develop. The method was therefore tried out with ordinary bacteria. Fig. 2 shows a slip with colonies of B. megaterium growing on it, *natural size*, from which it is seen that there is ample nutriment in such a thin layer.

Next we tried staining colonies on slips. Fig. 4 shows a colony of B. subtilis (× 1000), stained with dilute carbol fuchsin. As will be seen the bacilli have taken the stain quite well, whilst the agar layer has not stained sufficiently to interfere with the image. Another point is that, as the layer of agar is so thin, the organisms have grown out in practically one plane; almost the whole of this colony is in focus. This is a very useful peculiarity of the method, as it enables one to examine micro-colonies without the bacteria overlying.

Fig. 5 is a colony of pneumococci (× 1000), stained with fuchsin, which shows both the morphological characteristics of the organism and its method of growth. These are stained colonies, but to examine our pleuro-pneumonia colonies visually we must use dark-ground illumination. Fig. 6 is a photomicrograph of a slip colony of streptococcus pyogenes (× 1250), dark-ground illumination. The layer of agar does scatter some light, but not enough to interfere with the image, thus eliminating a point that might have been a serious obstacle. Mr. Barnard has already shown photomicrographs of slip colonies of bovine pleuro-pneumonia, taken with ultra-violet light and under dark-ground illumination, which show the purpose for which the slip method was devised. One great advantage lies in the fact that everything is done inside a test tube under ordinary bacteriological conditions, and the colonies may be examined *in situ* without fear of contamination during growth.

The method also lends itself very well to the mercury-droplet method of obtaining pure cultures from a single cell or micro-colony.* In fact Mr. J. Smiles, in the course of his investigations into the life cycle of bovine pleuro-pneumonia, has systematically made use of this method in order to obtain cultures from single organisms.

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* Topley, Barnard and Wilson, *Journ. of Hygiene*, 1921-9, **20**, 221-226, Barnard, J. E., *The Brit. Journ. of Exper. Path.*, 1925, **6**, 39-40.

XVII.—A NEW APPARATUS FOR CASTING PARAFFIN IMBEDDING BLOCKS.

By M. T. Denne, O.B.E., F.R.M.S.

(Read November 17, 1926.)

One Plate.

It cannot be said that the methods at present in use for the inclusion of objects in paraffin have been as carefully worked out as has the remainder of the technique of the preparation and mounting of sections, and a considerable amount of unnecessary labour is being devoted to the making of paper trays and the manufacture of blocks in imbedding Ls, to say nothing of the other methods of dealing with very small objects.

I have endeavoured to overcome these difficulties in the apparatus shown, and also to ensure that the two essential conditions making for perfect section-cutting are fulfilled.

These are, firstly, that the wax shall be perfectly homogeneous and free from bubbles; and, secondly, that cooling shall be so rapid that crystallization does not take place.

In addition, orientation, if necessary, under a magnifier or microscope, is easy, and a large number of very small objects can be very rapidly dealt with. Larger masses are also provided for, and the process is equally convenient for all.

In 1885 Selenka figured an apparatus consisting of a glass tube in the side of which a depression to contain the paraffin was formed, and through which could be passed hot or cold water as required.

In 1902 I described a method of orientation for small objects, involving the use of a tube from which the paraffin could be withdrawn by extracting a wire cage after momentarily heating the wax in immediate contact with the glass walls.

I have now been employing for some time the apparatus exhibited, in which the use of hot and cold water is combined with holders or " lifters " for removing the solidified cakes of paraffin.

In this apparatus there are two vessels connected together. In the top cover of that nearest the operator, which is firmly attached to the heavy base, there are formed depressions or chambers, adapted to receive objects of various sizes, and of sufficient depth to accommodate the largest.

These chambers are fitted with sheet-metal trays or "lifters" with projecting ends which can be readily grasped when extracting the blocks. The "lifters" fit closely into the chambers and are open on two sides.

The vessel, or jacketed pan, containing the chambers is fitted with three tubes, one of which is the cold-water supply, having a jet immediately under the central chamber in the interior of the chamber, the second a hot-water supply from the rear vessel about to be described, and the third a waste outlet.

The second or rear vessel is the heating chamber for the water. It is provided with a thermometer and is heated by gas from a burner beneath, or by an electric heater. It is carried on a pin, and may be lifted above the front chamber or lowered so that its top is beneath the bottom of the latter.

Its function is to permit of the quick introduction of hot water at a definite temperature into the jacketed vessel and of its quick withdrawal.

The operation of the apparatus is as follows: The rear vessel is filled with water which is brought up to a temperature 30° above the melting-point of the wax it is proposed to imbed with, and the "lifters" are put into the chambers in the front jacketed vessel.

Paraffin is then poured into the chambers, and the rear vessel, with its stop-tap opened, is lifted to the high position, when the hot water enters the jacket and maintains the wax at its correct temperature during the subsequent arrangement of the objects.

It has been found that if there is a difference of 30° between the water and the melting-point of the wax, the jacket will be kept a few degrees only above the melting-point, since considerable heat is abstracted by the cold jacket on the entry of the water.

There is a small gas burner under the jacket, so that, if orientation is extended for a long period, the heat may be maintained, but in practice this is seldom used.

Pieces of material are now taken up by means of a wire with a plate at right angles to form a lifter. If there are a number of small objects they are arranged in rows in the large chamber, or if larger and few in number they may be put into the smaller chambers.

A magnifier or erecting microscope may now be used comfortably and the objects precisely arranged at leisure.

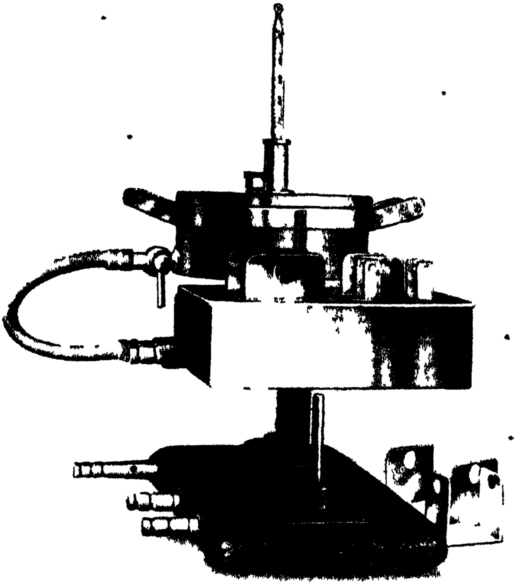
When all is ready, the rear vessel is lowered, the water allowed to run back into it, the tap shut off, and cold water circulated through the second pipe.

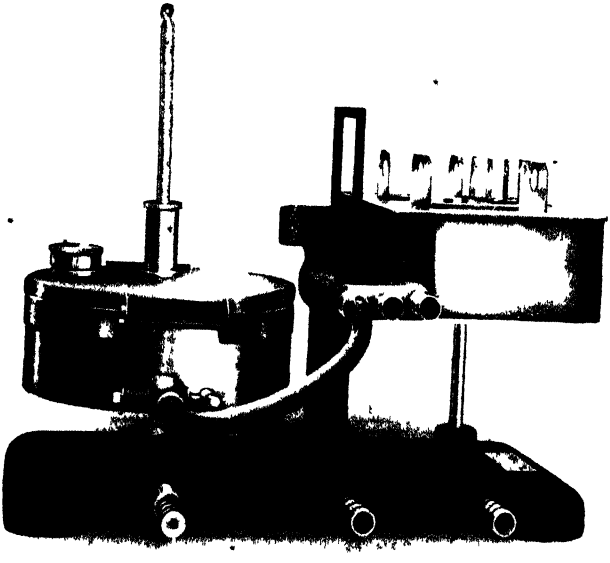
With the flow of cold water constantly renewed, immediately

EXPLANATION OF PLATE XXI.

Fig. 1.—**Shows the apparatus with the front chamber in the heating position ready for use.**

Fig. 2.—**Shows the same with the heating chamber lowered.**





below the chambers, cooling is exceedingly rapid, and a shell of solid paraffin several m.m. thick is obtained in a minute or so which effectually secures the objects in position.

The cold water is now stopped and that in the jacket is allowed to run off, when the rear vessel is lifted again and the hot water allowed to flow in. It has of course been heating meanwhile over its burner, and at once, on contact with the chamber, melts the surface of the wax on the walls, when the block may be lifted out by the cages or "lifters" without any risk of displacement of the objects. The whole is thrown into a basin of cold water to complete the solidification, when by merely springing the "lifters" open slightly the blocks may be disengaged and allowed to drop out.

The resulting mass contains absolutely no air bubbles, and is in excellent condition for cutting, having been very rapidly cooled.

The larger cages or "lifters" may have lines engraved on their surfaces, and specimens so small as to be invisible in the cooled paraffin may be located if arranged on cross lines by the Greenough or other microscope.

Where multiple imbedding has been done in a large block, it is of course necessary to divide it into pieces each containing a specimen. This I do with a thin saw having coarse teeth, by the use of which I eliminate all risk of injury to the specimen possible where a knife or razor is used to cut the block.

Furthermore, it is possible to imbed objects on a sheet of paper laid in the bottom of the chamber upon the "lifter." This paper may bear reference numbers, and may be allowed to remain in position during the cutting-up process so that the blocks can be stored for future use.

This works very well in practice.

It will be noted that the hot water in the rear vessel is heated preparatory to the next operation, while the cooling is being done in the jacket, and that it does not require renewal. The process is therefore very quick, and easily carried out.

XVIII.—TWO MICROSCOPES MADE BY G. ADAMS FOR KING GEORGE III.

By Reginald S. Clay, D.Sc., and Thomas H. Court.

(*Read November* 18, 1925.)

One Plate.

The late Sir Frank Crisp, as is well known to the older members of the Society, formed with the assistance of John Mayall a very fine collection of microscopes. After his death in 1919 the collection was sold at Messrs. Stevens's auction rooms, the more modern ones in 1920, and the antique ones on February 17, 1925. Among the latter were two microscopes made by George Adams for George III., the one while he was Prince of Wales, and the other, a magnificent specimen of silver work, after he became king. These and other of the Royal microscopes were identified, and the former was purchased by the South Kensington Science Museum for 26*l.* The silver microscope sold for 360*l.*, and passed into private hands. As these microscopes embody many important features we think an account of them should be put on record.

A brief account of the maker, George Adams the elder, may be of interest. It is not known when he began business, but an advertisement of a catadioptric quadrant (the earliest sextant) in the "Evening Post" of December 17, 1735, shows that he was established as a mathematical and instrument maker at the Tycho Brahe's Head in Fleet Street, London. In an unpublished manuscript in the Court library on the Orrery, which is in Adams's own handwriting, and is signed and dated 1741, it is stated that his shop was at the corner of Racquet Court, Fleet Street. From a letter dated the 1st January, 1735/36, which was with the microscope described in the Society's Journal of February 1912, p. 125 (and figured in the same volume, p. 445), we find that he was making instruments for the East India Company.

Adams published a number of books dealing with microscopes, the chief of which, "Micrographia Illustrata," first edition, appeared in 1746. It contained an account of a "New Universal Microscope," which was made to an entirely original design, and of which the microscopes dealt with in this paper are a further development. The second edition, 1747, was identical with the first.*

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* The original description of the Universal Microscope in Adams's own handwriting is in the possession of Mr. Court. It differs in a few unimportant particulars from the published account. The microscope is here called a "New Portable Microscope." There are with it three proofs of the plates before letters, and the original black and white drawing of the Frog Holder.

In 1766 Adams produced his celebrated work on the Globes, for which Dr. Samuel Johnson, the lexicographer, wrote the dedication to the King, and for so doing received a present of "very curious meterological instruments of a new and ingenuous construction." This popular work passed through a number of editions. The fourth edition of the "Micrographia Illustrata" appeared in 1771. (If there ever was a third edition of this work it appears to be unknown, and must be a very rare book. Its discovery is greatly to be desired, as it would bridge the important period between 1747 and 1771, during which these remarkable Royal microscopes were produced.) This fourth edition contained an account of his "Variable Microscope," concerning which Adams says: ". . . We owe the construction of the variable microscope to the ingenuity and generosity of a noble person," and the identity of this anonymous nobleman has given rise to much speculation. It has been suggested with some apparent probability that it was Sir Henry Cavendish, F.R.S., but this is not the case. For in the first edition of "The Construction of Timber" by Sir John Hill (self-styled), which was published in 1770 (a year before the "Micrographia"), there is an illustration of the variable microscope, and Hill says that the design of the microscope was due to his patron and the patron of his book—Sir John Stuart, Earl of Bute (1713–1792). The name of this minister of George III. is not generally associated with scientific pursuits, but he was a lover of science and a liberal patron of scientific men. His large collection of mathematical and philosophical instruments, comprising 255 lots, was sold by auction by Mr. Hutchens at King Street, Covent Garden (now Messrs. Stevens's auction rooms), on February 5, 1793, and two following days. The unique catalogue of the sale is in Mr. Court's possession.

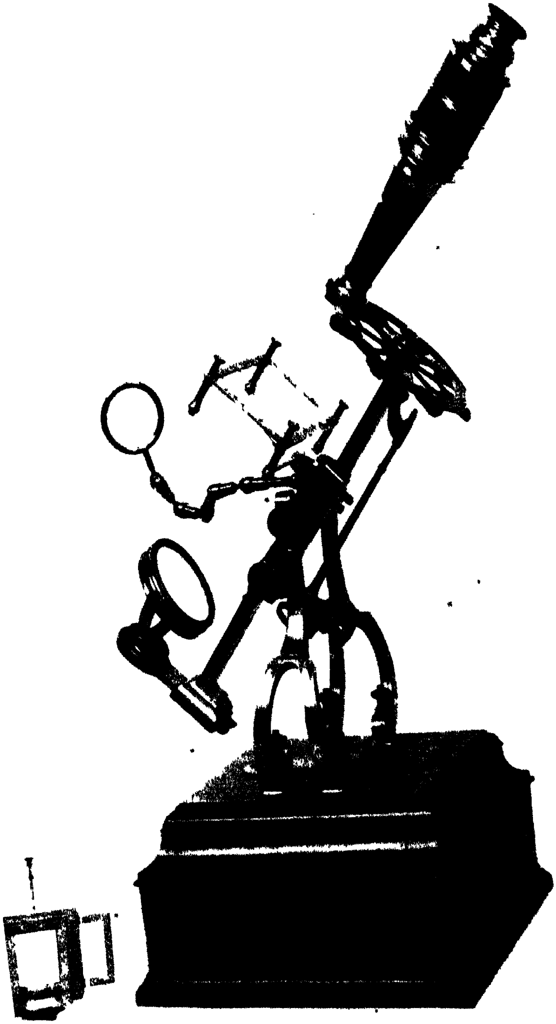
An advertisement of a new sea quadrant shows that Adams in 1748 was already mathematical instrument maker to His Majesty's (George II.) Office of Ordnance. He was afterwards appointed mathematical instrument maker to the Prince of Wales, and so became mathematical instrument maker to him as King George III., of which title he was very proud, inserting it on all his later instruments. Adams, of course, was a maker of all kinds of scientific instruments.

He died in 1773, leaving a widow and two sons; the elder, George, succeeded to the business, which on his death passed to his younger brother, Dudley.

Regarding the two instruments themselves: the most artistic, elaborate, and in some ways most interesting microscope in the Crisp sale was the large silver microscope illustrated. Because it was for the King himself Adams endeavoured to produce an instrument that should be the last word in microscope construction, and at the same time beautiful. It bears the inscription, "Made by George Adams"; the usual addition, "Instrument Maker to the King," is omitted, in view of the destination of the instrument. Adams refers to it in the fourth edition of his "Illustrata," 1771, p. xlix (in which he describes the eye-piece micrometer). He says: "It was made for His Majesty in the year 1761, and with it was then presented a manuscript of its use. . . . The screw has fifty threads to an inch, it carries an index pointing to the divisions on a circular plate fixed at right angles to the axis of the screw; its revolutions being counted on a scale of one inch divided into fifty parts." All of this description coincides with the micrometer of this microscope. It is described in the original manuscript catalogue at King's College as "A large Microscope mounted in silver by Adams."

The instrument is built on and around a silver-cased Corinthian pillar some 13 in. high. To right and left of the pedestal of this pillar are two other similar pedestals, each surmounted by an ornamental vase or urn, and separated from the central pedestal by about 3 in. of decorated silver tubing. At front and back of the side pedestals are found extensions or feet, each made up of a cherub and foliage, intended to give the instrument stability.

On the front and back of the main pillar are two stages and two mirrors, which are exact replicas of each other. The stages move independently. Each stage can slide in vertical slots in the pillar and be clamped at any desired height, providing a coarse focussing adjustment. After the stage is clamped by two screws, one at the top and one at the bottom of a slide which is at the right side of the pillar as you face the stage, the final focussing is obtained by a screw (41 threads to the inch), which is also on that side of the pillar. The screw is carried in bearings fixed to the top and bottom of the coarse-adjustment slide abovementioned, and this screw moves an arm attached to the support of the stage. This arm is split where it forms the nut for the focussing screw and has a screw to tighten it to take up the wear, so that it shall remain a good fit, free from back-lash. The support for the stage appears to be a piece of angle steel, with the arm just referred to projecting through the right side of the main pillar and with two brackets projecting through the front of the pillar; these brackets are about 3 in. apart. The stage itself has two movements in arc. It is first carried on a vertical axis, which is pivoted at top and bottom in the brackets just described. At the bottom, this vertical axis has attached to it a quadrant gearing in a worm. The worm, which has 27 threads to the inch, can be thrown in and out of gear by a screw with a milled head, which causes the little bracket in which the worm is carried to move to and fro in a dovetail slide. The axis is continued above the top bracket as a sort of twisted scroll; at the farther and outer end of this scroll is a short vertical bearing in which the stem



of the ring-stage rotates. The end of the scroll also carries another worm, moving in and out of gear on a dovetail slide by means of a screw as before; this worm actuates a toothed arc attached to the end of the stem. Thus, the stage is a mechanical one, provided with rotations about a pair of parallel axes. The stage consists of two rings, 2½ in. diameter and ⅜ in. wide, one above the other—the upper is fixed directly to the stem; the lower ring slides vertically and is held up against the upper one by a curious wire spring, which is coiled to and fro in one plane. On the rim of the fixed ring is a vertical socket to carry a substage condensing lens.

The mirrors, plane and concave, 2 in. diameter, are attached to the pedestal of the main pillar.

Above the capital of the pillar is fixed a more or less circular and flat platform which carries two microscopes, a compound one in front over one stage, and a single microscope at the back over the other stage. The compound body is upheld by two graceful, partially draped female figures. The body tube is beautifully ornamented; its lower end is somewhat conical. The eye-piece is enclosed in a twisted scroll, and it has two lenses, a bi-convex field-lens, 2½ in. focus, and an eye-lens, 1 in. focus; their separation is about 2⅜ in. The eye-cap is blackened inside.

The micrometer in the eye-piece has already been partly described. It has, however, in addition to the slow motion given by the screw, a quick movement given by a rack. The screw carries the pinion which moves the rack, and the rack carries the pointer which is in focus in the eye-lens.

There are eight powers, carried on a large wheel, which rotates just below the platform. These are common to both microscopes.

For the single microscope there is an eye shield, blackened inside.

The microscope is fitted with a substage condenser, supported on a rod sliding in a tube at the edge of the stage. It is, perhaps, the earliest example of a microscope so fitted. There is, in addition, a superstage condenser, carried on a jointed arm, which is attached just in front of the compound body. The arm has three ball and one Hooke joint.

The accessories consisted of:—(*a*) A stage forceps with the usual spring at one end, and the ivory and black disc at the other; (*b*) a silver frog plate of ordinary pattern; (*c*) an ivory box for rings and mica discs; (*d*) a screw cap to cover the top of the compound body.

The whole instrument appears to be made of brass and steel, cased with beaten silver, and is a fine specimen of the silversmith's art.

The other instrument—the Prince of Wales's microscope—must have been made prior to 1760, and assuming it to have been made for George III. whilst Prince of Wales (as we have no evidence Adams was ever maker to Frederick, his father), it must have been made between 1751–1760.

Its most interesting and arresting feature is its method of support on trunions at its centre of gravity; it was probably the first microscope so supported. It is strange that this excellent method was not persisted in by Adams. It would be very interesting to know what suggested the trunions to Adams, and why he discontinued their use. Why did he abandon them for the mechanically poor design of the Variable? Was it to please his wealthy patron?

The trunion in the Prince of Wales's microscope supports the limb near the point of attachment of the stage. There is a spring on the box-foot with a pin which fits in a hole in the bottom of the limb to clamp it in an upright position. The limb is a rectangular bar, sliding alongside which is a second similar bar, as in the Cuff model. This second bar carries the microscope body; it has also the Cuff adjustment screw (46·2 threads to 1 in.) for fine focussing. This screw has an interesting crown-wheel, gearing with a wheel on a horizontal axis actuated by a milled head. The connecting arm, in which the focussing screw works, is split, and is provided with a screw for tightening it to take up wear, as in the silver microscope. The lower end of the body is somewhat conical, and is made of brass covered with fish-skin; the upper end forms the eye-piece, which is optically identical with the eye-piece of the silver microscope.

There are three stages; two fit on by a dovetail slide (the jaws are of steel). One is of great interest, having micrometers registering in two directions at right angles. The screws have exactly 100 threads to 1 in., and the head is divided into 100 parts, so that it reads to 1/10,000 in. The nuts in which the screws work are split, but have no tightening screws. The screws are carried in bearings, one near the head and the other at the far end. The stage has two other slides for quick adjustment in addition to the micrometer motions. All four slides are in dovetails. The second stage is a single ring stage, like the one supplied with his "Universal Microscope" already alluded to. The third is a frame with cross threads for frogs, etc.

Both these instruments have spring plates on the focussing slides to keep them from shaking.

Round the rim of the cover to the large wheel of powers, of which there are eight, varying from 1/20 in. to ⅞ in., each mounted in a separate slide, is the inscription "Invented and made by George Adams in Fleet Street, Mathematical Instrument Maker to His Royal Highness the Prince of Wales." In one of the two drawers in the box-foot are three more powers. The mirror is similar to that of the silver microscope. It is carried in an extension attached to the limb, its support being inserted in a hole in a larger disc, which screws in a ring about 1 in. diameter, intended no doubt to enable this microscope to be attached to a solar microscope in the same way as his Universal Microscope could be attached. The box-foot still has upon it the Royal label, No. 609.

This one is, as already stated, in the South Kensington Science Museum. It seems a pity that both of these historically priceless instruments should not have been secured for the nation.

XIX.—NOTE ON THE DEVELOPMENT OF ALLOTHROMBIUM FULIGINOSUM HERMANN.

By Stanley Hirst, F.L.S.

(*Read December* 15, 1926.)

Two Plates.

(*Published by permission of the Trustees of the British Museum.*)

In 1882 Henking published his classical memoir on *Allothrombium fuliginosum* Herm., which has been of great service to students of acarology. The present brief note deals with some of the more interesting details in the life-history of this mite, special attention being directed to the prelarval stage.

My best thanks are due to Mr. K. G. Blair, Dr. E. Carter, of Enfield, and Mr. Edward King, of Pulborough, who have kindly supplied me with the live specimens of *Allothrombium fuliginosum* used in this research.

Brief Summary of Postembryonal Stages.

These are as follows :—1. Ovum. 2. Prelarval stage. 3. Larval form. 4. Resting stage of larval form. 5. Nymph. 6. Adult male or female.

1. The ova are bright red when deposited, usually in a single large cluster. They become much paler before splitting to release the practically inert prelarval stage. Egg-shell smooth and fairly thick, being strongly chitinized.

2. *Prelarval Stage.*—Integument thin but tough, being chitinized Rudimentary palpi and six rudimentary legs are present. Both body and limbs are furnished with numerous minute pointed *scales*, very similar to those present in *Sarcoptes*, but still smaller. These scales are no doubt used to aid movement when this prelarval stage is still in the egg-shell. In addition there is on each side of the body a sharp little projection or tooth presumably employed in cutting open the shell. A little *excretory pore* (uropore) is situated on the body above the first and second limbs. Rudimentary legs without any trace of claws or pulvilli. Segmentation of these

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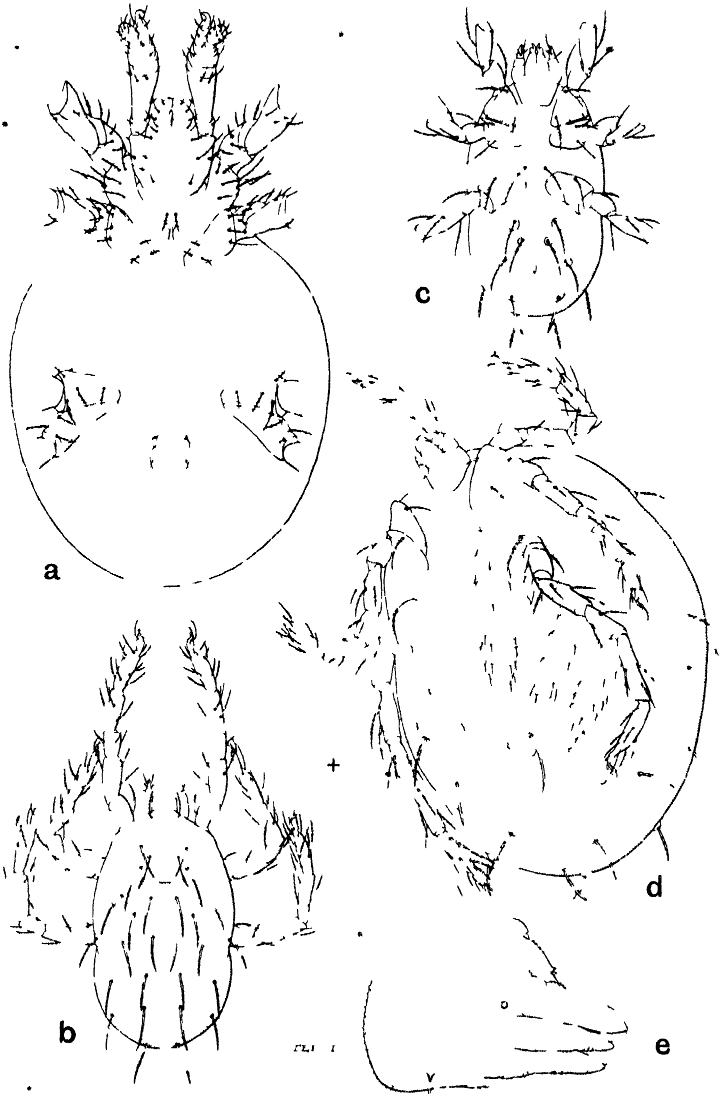
EXPLANATION OF PLATE XXIII.

(*a*) Ventral view of nymph of *A. fuliginosum* Herm.; (*b*) and (*c*) larval stage; (*d*) nymphochrysalis; (*e*) prelarval stage.


a
b
c
d
e

limbs rather indistinct, but indicated by three or four smooth transverse furrows, the scales or granules in these furrows being weak or absent; in the deepest part of the furrows distinct but incomplete transverse lines can also be seen. First limb much stouter than the others.

This prelarval stage is the so-called deutovum of Clarapède and Banks, and supposed by these authors to be merely a development of the inner lining of the ovum. The name apoderma is applied to it by Henking. It seems more probable that it represents an additional larval stage that has been suppressed in other groups of Acari.

3. *Larval Stage.*—(Pl. XXIII. figs. *b* and *c*). This larval stage is very active, and within a day or two attaches itself to some aphid host. The following is a condensed account of its structure. Principal anterior *scutum* on the *dorsum* well developed, being longer than wide, and bearing four pairs of hairs, including the pseudostigmal pair, the latter situated well behind the middle of the scutum and widely separated from one another. Immediately behind the principal scutum there is another transversely elongated little chitinous plate bearing a pair of hairs. On either side of it there is a pair of little subcircular platelets, each bearing a single hair. *Venter* also with little plates, but they are not so regular in shape or size as the dorsal ones.

4. *Inert or Parasitic Stage of Larva* (Nymphochrysalis of Henking).—After attaching itself to an aphid the larva soon greatly increases in size. It then falls off and becomes motionless, being oval in shape (fig. *d*). The outline of the developing nymphal stage can be seen in mounted preparations of this stage. Besides the nymph itself there is, however, another skin or envelope situated between the nymphal skin and that of the motionless larva. This intermediate structure resembles the prelarval stage rather closely, having rudiments of legs (apparently eight in number). Its integument is very delicate, but is distinctly ornamented with granules. This very weakly chitinized structure can only be seen in preparations well cleared with potash Probably it represents a suppressed nymphal stage. This intermediate structure is marked + in fig. *d*; it is quite well shown in Henking's figs. 36-39. He also depicts a similar structure in the interior of the nymph when developing into the adult. If both these rudimentary nymphal structures are counted as nymphs the nymphal stages would in all be three in number, thus agreeing with E. Reuter's estimate given in his excellent work, "Zur Morphologie und Ontogonie der Acariden," Act. Soc. Sc. Fenn. 36, 1909, p. 192, etc.

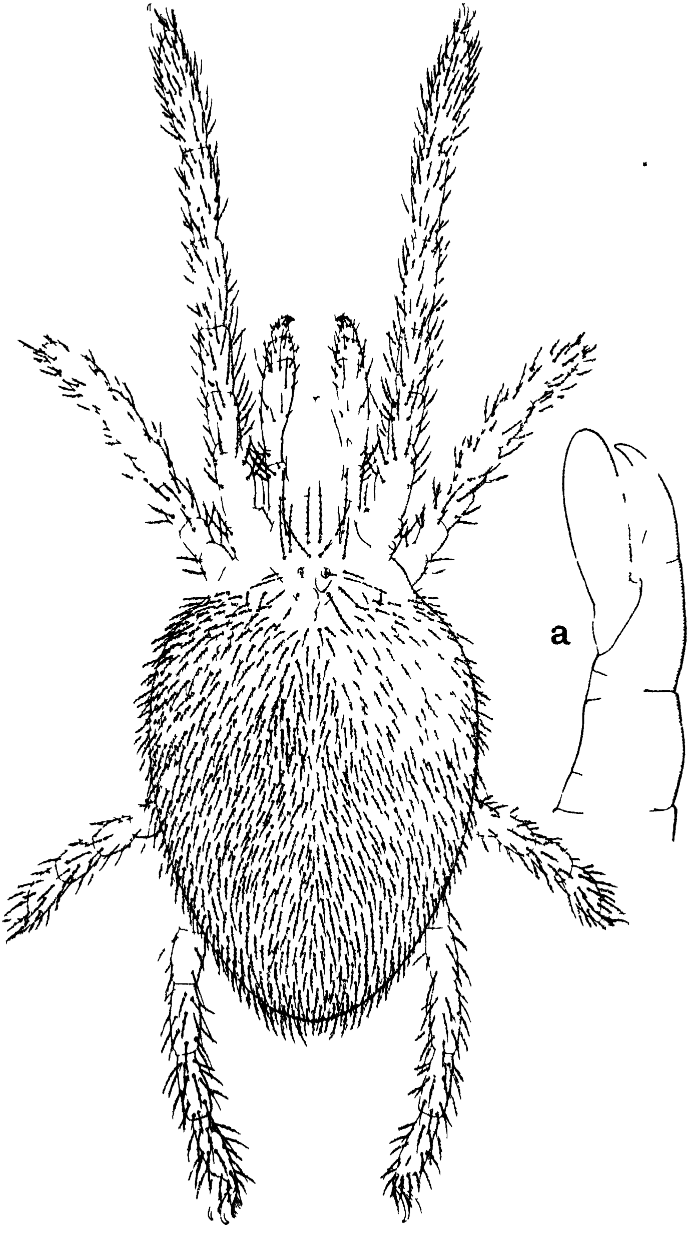
The *nymph* and *adult* are so well known that I will refrain from describing them in detail. After emerging from the nymphochrysalis the nymph is at first rather short as compared with its width, but afterwards becomes more elongated in form (figs. *b*, *c*). The genital suckers are six in number.

Duration of Development.—Adult females of *A. fuliginosum* from Pulborough deposited ova on April 24th. Active larvæ emerged on June 5th. Nymphs appeared July 8th-12th. Adult females from Enfield deposited ova May 3rd. Ova mostly split and prelarval stage visible by May 13th. Active larvæ emerged on June 1st-3rd. Several attached to aphids on June 3rd. Active nymphs appeared on July 9th.

Feeding Habits.—The adults of *A. fuliginosum* suck the juices of aphids, seeming to prefer the inert stages of the insect. They will also feed on freshly-killed flies and their maggots. On one occasion a female of this species of mite was observed to attack and suck the juice of a moribund male specimen of its own species. Two species of aphids, viz. *Macrosiphum gei* (Koch) and *Myzus persicæ* (Sulzer), both occurring on the common dock, were used as food for the adults of *A. fuliginosum*. The larval stage attached itself readily to either of these species of aphids.

EXPLANATION OF PLATE XXIV.

Dorsal view of nymph of *A. fuliginosum* ; (*a*) palp of same enlarged.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XX.—A METHOD OF STAINING SECTIONS IN ACETONE.

By Andrew Kefalas, M.A., M.B., Ch.B., F.R.M.S., etc.

(*Read December* 15, 1926.)

The following modification of a routine method of staining sections has been found satisfactory enough to suggest that it might be of interest to others. The material treated consisted of pathological and physiological sections in which the more minute details were not of importance, and the use of acetone for fine details such as centrosomes and the like has not yet been attempted.

The stains used were a modification of Weigert's iron-hæmatoxylin and Biebrich scarlet. They were as follows:—

Solution No. 1:—

Liq. ferri sesquichlor. (double B.P. strength) .	3 c.cm.
Pure strong hydrochloric acid	1 drop.
1 p.c. solution of ripe hæmatoxylin in good acetone to	100 c.cm.

Solution No. 2 consists of a saturated solution of Biebrich scarlet (Grübler) in acetone.

Stoppered glass cylinders of the old type are required for this method, the newer ones with glass caps being useless for obvious reasons. Six cylinders are filled and arranged in this order:—

1st cylinder	Benzene (cryst.) or xylol.
2nd „	Acetone.
3rd „	Solution No. 1 (hæmatoxylin).
4th „	Solution No. 2.
5th „	Acetone.
6th „	Xylol or other suitable clearing agent.

The paraffin is removed in the first cylinder as usual, and the slide is immersed a moment in the second. It is then left in the hæmatoxylin until it is very slightly over-stained. It is then counter-stained in the Biebrich scarlet, and when this operation is complete, it will be found that some of the hæmatoxylin has been extracted and the section is just right. The slide is then passed through the fifth cylinder and then lastly the clearing agent, when it is ready for mounting in balsam in the usual way.

There are two precautions to be observed. The slides must be transferred from one cylinder to another very rapidly, as acetone is so very volatile that the slightest delay in changing will result in the section becoming dried and thus completely ruined. It is best, when transferring from one cylinder to another, to remove both stoppers before moving the slide, and this way there is no danger of spoilt sections. Cylinders containing any acetone must be kept tightly stoppered except at the moment when slides are being put in or taken out, or the acetone not only will evaporate but will absorb moisture and deteriorate.

All solutions can be used repeatedly as long as the precaution anent the stoppers is rigidly regarded, and a goodly number of slides can be done before the reagents begin to deteriorate. The fifth cylinder is not really necessary, but it constitutes a good precaution and lengthens the life of the other reagents.

The advantages of the method can be summarized thus:—

1. The sections never leave a fixative vehicle.
2. They are subjected only to the very slightest variations of osmotic tensions when transferred from one vehicle to another, and thus sections damaged by osmosis are an unknown quantity.
3. It is cheap.
4. It is extremely rapid, and large numbers of sections can be put through in a suprisingly short time.
5. Clearing is always complete and instantaneous.
6. Sections can never come out over-stained.

The disadvantages are few, but have to be noted:—

1. Acetone is extremely inflammable and reasonable precautions have to be observed.
2. It is very volatile, and great care and speed are required, as has already been noted, in transferring slides from one vehicle to another.
3. It is essential that the acetone should not contain more than a mere trace of water. It is not necessary to use chemically pure acetone—a good commercial sample will usually suffice, but this point requires attention.

It is, perhaps, needless to add that the modified solution of hæmatoxylin lasts no longer than the original Weigert's solution, and has to be renewed after a few days.

XXI.—SOME POINTS IN THE LIFE-HISTORIES OF YEASTS.

By J. Ramsbottom, O.B.E., M.A., Sec. L.S.

(Read at the SHEFFIELD CONFERENCE, April 21, 1925.)

Yeast fungi are of many-sided interests. Their fermentative properties have caused gladness in the heart of man since the beginning, their nuclear structure has been responsible for much heart-burning, and their life-cycles and phylogeny have always appealed to botanical examiners. The method of vegetative growth known as "budding" is characteristic of yeasts, though not confined to them, being known to some slight extent in every group of fungi. The essential character of yeasts is that they produce internal spores, known as endospores or ascospores. Endospore formation (sporulation) can often be induced by placing well-nourished yeasts on plaster of Paris blocks or on some special medium such as that of Gorodkowa. On the other hand, certain yeasts apparently can never be made to sporulate. The work of Kruis and Šatava published in Czecho-Slovakia in 1918 seems to fill in some of the gaps in our knowledge. (The late Karel Kruis was Professor of Fermentation Chemistry and Photography at the Technical University of Prague; Jan Šatava is his successor.)

While working with "Springer," a Viennese pressed yeast, they tried whether a laboratory culture could be rejuvenated by inducing endospore formation and cultivating the fungus from the ascus. The cultures resulting from the endospores, however, differed in many ways from the normal form. The cells were only about half the size, were spherical rather than elliptical, and formed thick, compact, persistent colonies in place of being loose, radiating and evanescent. Moreover, the dwarf form retained its characters during several months—in certain cases for as long as three years under the most favourable cultural conditions. The most striking difference between the two forms is the fact that the dwarf form does not produce endospores when placed on gypsum blocks. Similar results were obtained with other yeasts, and a clue to their explanation was found in the wine yeast "Melnik," which, owing to its method of growth, is very conveniently examined. It was seen here that the endospores either germinate directly and give rise to the dwarf form, or else copulate in pairs and produce the normal form. It thus seems that there is an alternation of generations, the normal form being the vegetative stage and the dwarf form the sexual stage. A series of yeasts showed the same phenomena, and can be divided into two groups; in some the spores rarely conjugate, with the result that small-celled colonies are the rule, while in others the spores or their immediate descendants frequently fuse, with resulting large-celled colonies.

These two types of spore suggest some similarity with the so-called homothallic and heterothallic strains now known in every group of fungi. Kruis and Šatava made a few preliminary experiments to test the presence of plus and minus strains, but apparently only three dwarf cultures were tried.

The modes of fusion of the endospores of *Saccharomycodes Ludwigii* suggest that there is probably a segregation of strains similar to that which occurs at the formation of sporidia in the Ustilagineæ.

It is possible that some of the numerous "species" of *Torula*, so troublesome particularly to medical men and to brewers, are really dwarf forms or strains of *Saccharomycetes*. The importance of this work to the brewing industry is apparent, from the fact that "Hofbrau" yeast, which is of the typical "Frohberg" type in the normal (vegetative) form, is of the "Saaz" type in the dwarf sexual form. A further point is that support is lent to Nadson's view of the primitiveness of the sexuality of *Saccharomycodes Ludwigii*, as against the more generally accepted view of Guilliermond. The photographic slides employed to illustrate * these notes were made by Professor Kruis by means of cadmium light at a uniform magnification of 1,200 diameters.

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* At the Sheffield Conference.—Ed.

SUMMARY OF CURRENT RESEARCHES

RELATING TO

ZOOLOGY AND BOTANY,

(PRINCIPALLY INVERTEBRATA AND CRYPTOGAMIA),

MICROSCOPY, ETC.*

ZOOLOGY.

(*Under the direction of* DR. C. DA FANO)

CYTOLOGY IN GENERAL.

Structure of Yolk-Spheres.—C. GOLGI ("Intorno alla struttura ed alla biologia dei cosidetti globuli (o piastrine) del tuorlo," *Atti Ist. lomb. sci. lett.* (*Mem.*), 1923, **13** (S. 3), 161–3, 1 pl.). Though published more than three years ago, this paper (the last which Golgi wrote) appears to have so far escaped the attention of most cytologists. It deals with investigations on yolk-spheres (chiefly of frog's eggs) which he carried out by means of the following method: Fix for any length of time in equal parts of 3 p.c. potassium bichromate, 3 p.c. corrosive sublimate and 20 p.c. formalin, adding to the mixture a few drops of acetic acid. The eggs can then be used for direct observation after crushing them in glycerol or—by preference—they are washed in distilled water and passed into a ½ p.c. solution of silver nitrate (length of time of the silver bath not stated). After washing once more, the eggs are broken in some glycerol to which one drop of a photographic reducer is added. If the eggs are studied in winter, the yolk-spheres are constantly structureless, but if observations are made at the beginning of spring and then in the succeeding months, the following structural details appear in them in chronological succession: (1) one or two bodies identical in aspect and situation with centrosomes; (2) a differentiation of the most superficial portion of each globule into an apparent capsule; (3) granules and short rods similar to mitochondria; (4) a system of fibrils; and (5), when the spheres have reached their greatest size, well impregnated filaments or batonnets which sometimes remind one of dictyosomes, and sometimes of chromosomes arranged into an equatorial plate. From these observations the author concludes that the yolk-spheres, so far considered as devoid of any structure or life, may under certain conditions acquire histological appearances which we generally regard as proper to living elements alone. C. D. F.

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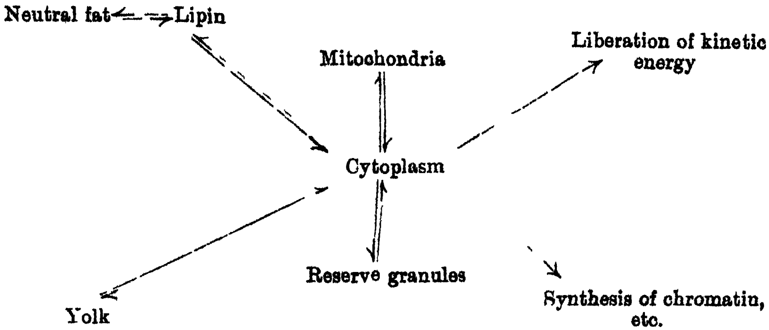
* The Society does not hold itself responsible for the views of the authors of the papers abstracted. The object of this part of the Journal is to present a summary of the papers *as actually published*, and to describe and illustrate Instruments, Apparatus, etc., which are either new or have not been previously described in this country.

A. VERTEBRATA.

a. Embryology, Evolution, Heredity, Reproduction, and Allied Subjects.

Spermatogenesis of Umbra Limi.—J. O. Foley ("The Spermatogenesis of *Umbra limi* with Special Reference to the Behaviour of the Spermatogonial Chromosomes and the First Maturation Division," *Biol. Bull.*, 1926, **50**, 117–40, 3 pls.). The spermatogonia of *Umbra limi* are formed anew each season from cells which migrate from some point outside the lobule or even outside the testis. Evidence points to the presence of definite pro-chromosomes in the early spermatogonia. The somatic and spermatogonial number of chromosomes is 22; they may exhibit contractions, but extreme contraction simulating transverse fission is unusual. Two L-shaped chromosomes are found in all spermatogonial cells; they may be sex-chromosomes; if so, the male of *Umbra* is of the XX type. The multiplication divisions of the spermatogonia are very rapid so that the final spermatogonia are only one-sixth to one-third the volume of the original ones. The primary spermatocytes show an increase in nuclear size of 15 to 20 p.c. over the spermatogonia of the preceding multiplication division. The chromosomes emerge from synizesis as rods of varying length and thickness. During diakenesis tetrads of the closed ring type appear. Transversely constricted chromosomes are sometimes observed, but they play no part in the maturation divisions. The tetrads have a median fibre attachment and separate into dyads at the metaphase of the first maturation division. The secondary spermatocytes may go into a resting stage, but usually the telophase of the primary spermatocyte passes into the metaphase of the second maturation division when the separation of the dyads is very rapid. No unusually large chromosomes are observed in the first or second maturation divisions. The nuclear material of the transforming spermatid contracts as the head of the spermatozoon forms. C. D. F.

Eggs of Teleosts.—M. J. Guthrie ("Cytoplasmic Inclusions in Cross-Activated Eggs of Teleosts," *Zs. Zellforsch. mikrosk. Anat.*, 1925, **2**, 347–81, 3 pls.). Cross-activations between *Fundulus heteroclitus*, *F. majalis*, *Menidia menidia notata*, *Ctenolabrus adspersus*. The transformation of yolk into cytoplasm takes place more quickly beneath the blastodisc than elsewhere. The yolk forms a fine emulsion during this change. The order of change is neutral fat to lipin to cytoplasm. In general there is an increase of mitochondria in the newly formed cytoplasm. These then represent the equilibrium of the cell with respect to its lipin content. They are precipitated out on saturation of the cytoplasm with lipin protein, this state being typical of the cytoplasm. Respiration and reduction are more likely to be performed by the colloidal phospholipine and fatty acids than by the coarse mitochondria. The equilibrium may be expressed as follows :—



Possibly hybrid development can be explained on the assumption that the egg cytoplasm is not constituted to support the foreign chromatin as well as its own metabolic activities. L. A. H.

Meiotic Phase.—C. E. WALKER ((I) "The Meiotic Phase in Triton (Molge vulgaris)" ; (II) "The Meiotic Phase in certain Mammals," *London, Proc. R. Soc.* (B), 1925, **98**, 29–43, 9 pls., and 1925–26, **99**, 366–73, 3 pls.). (I) According to Digby a thread is the longitudinal half of a filament; a filament is an entire univalent spireme or chromosome produced by the lateral association of two threads. The prophase of all divisions finds the chromatin as barely visible threads. These gradually become thicker, approximate in pairs and form filaments which in somatic divisions give rise to an apparently continuous spireme. This breaks into twenty-four chromosomes which split longitudinally, the daughter halves passing to the poles and forming the daughter nuclei. In the telophase the daughter chromosomes split again longitudinally into semivalent threads which gradually become thinner almost to disappearance. In the first (heterotypical) division of the meiotic phase the threads thicken and unite in pairs as in the somatic prophase and form filaments which also come to lie in pairs. These are all parallel for some distance at one pole but they diverge at the other. The threads forming each filament are fused at the parallel ends of the pairs but diverge to form a loop at the other end and so give a bouquet stage. Both threads and filaments thicken and the latter approach and fuse giving rise to twelve bivalent loops which are at first loose in texture but gradually become denser and sharper. The filaments separate in the middle of the loops and finally are only joined at their ends. The twelve pairs of filaments or loops assume characteristic shapes and form the bivalent chromosomes (gemini) of the first meiotic division. At division the pairs separate into two complete somatic chromosomes, one going to each pole and thus to each daughter cell. According to these observations there is no fission of the individual chromosomes in the first meiotic division ; "the cell as a whole divides into two daughter cells and the individual chromosomes are distributed, half of them going to each of these." The second meiotic division resembles the somatic except that only half the number of chromosomes is developed. In the telophase the daughter chromosomes and the filaments derived therefrom divide into threads though there is no mitosis in prospect until the first segmentation after fertilisation. (II) In the meiotic phase in the mammals investigated (guinea-pigs, rats, mice, rabbits and a monkey) similar phenomena occur, viz. the daughter chromosomes elongate and divide longitudinally into semivalent threads; during the process an appearance similar to that seen during synapsis is evident; the threads then rejoin in pairs forming univalent filaments and these join laterally in pairs. They again separate except at their ends which remain joined until the first meiotic division takes place. The longitudinal split of the filaments into semivalent threads reappears at the telophase and is consummated at the second meiotic division. L. A. H. and C. D. F.

β. Cytology and Histology.

Histological Observations on Pancreatic Secretion.—E. S. Horning (*Austr. J. Exp. Biol. Med. Sci*, 1925, **2**, 135–8, 1 pl.). The zymogen granules appear to arise in the pancreatic cells of the guinea-pig from the filamentous mitochondria. This suggests the enzymatic nature of the latter. The formed zymogen grains are then secreted as globules into the acini. C. D. F.

Intestinal Fat Absorption.—W. Cramer and R. J. Ludford ("On Cellular Changes in Intestinal Fat Absorption," *J. Physiol. Cambridge*, 1925, **60**, 342–6, 9 figs.). Investigations were carried out on rats and mice by means of Ludford's modification of the Mann-Kopsch method for the demonstration of the Golgi apparatus. When fat absorption is proceeding most actively the apparatus swells up and enlarges so as to form a network nearly filling the part of the cell between the nucleus and the free border, with the globules of synthetized fat lying in its meshes. Conditions intermediate between the highest degree of fat absorption and its complete absence are correlated with relatively intermediate changes in the form of the apparatus. Absorption of food-material other than fat by the epithelial cells is not associated with any change in the Golgi apparatus. Mitochondria do not appear to undergo any morphological change during fat absorption. C. D. F.

Cell Changes in Thyroid.—W. Cramer and R. J. Ludford ("On Cellular Activity and Cellular Structure as Studied in the Thyroid Gland," *J. Physiol. Cambridge*, 1926, **61**, 398–408, 12 figs.). Conditions were established which would induce intense activity and complete inactivity respectively of the thyroid gland in rats, and the material was investigated by Ludford's modification of the Mann-Kopsch method for the Golgi apparatus and Heidenhain's iron-alum hæmatoxylin after Schridde's fixation. The Golgi apparatus showed the same changes as observed in other gland-cells in rest and activity; a simple contracted form in the resting cell, an enlarged convoluted form during activity followed by a disintegration into granules. The mitochondria were barely visible in the resting-cells but exhibited an enormous enlargement in active glands. This change is discussed by the authors from the point of view of cell mechanics. They suggest considering the mitochondria as "a mechanism by which the cell can produce great variations in surface energy within the cell." C. D. F.

Golgi Apparatus of the Liver Cell.—W. Cramer and R. J. Ludford ("On the Cellular Mechanism of Bile Secretion and its Relation to the Golgi Apparatus of the Liver Cell," *J. Physiol. Cambridge*, 1926, **62**, 74–80, 15 figs.). The authors have examined the livers of normal and pregnant mice, rats and guinea-pigs, and also the livers of the same animals following injections of insulin, pituitrin and β-tetrahydronaphthylamin; feeding with thyroid and a tryptophane-free diet; exposure to cold; removal, after ligature, of a piece of the common bile duct. Two extreme conditions of the Golgi apparatus were observed: one was represented by the small juxta-nuclear network corresponding to the appearance of the resting apparatus in other gland cells; the other extreme was characterized by the presence of osmophil canaliculi lying at the periphery of the liver cells and making contact with the intercellular bile capillaries. Between these two extreme conditions, various intermediate forms of the apparatus were seen. These observations lead the authors to the conclusion that in the liver cells the bile constituents appear as a secretion within the apparatus which first enlarges and then fragments. The fragments are dispersed through the cytoplasm and reach the periphery where they pass their contents into the intercellular bile capillaries. C. D. F.

Rouget Cells and their Function.—H. W. Florey and H. M. Carleton (*London, Proc. R. Soc.* (B), 1926, **100**, 23–31, 4 text-figs.). Observations were made on the mesentery of the cat and dog by means of one or the other of the following intra-arterial methods of fixing and staining. (1) The intestines together with the mesentery are removed from the chloroformed animal and kept warm by saline swabs. A cannula is inserted into the mesenteric artery and another into the largest branch of the portal vein. The blood is washed out by the perfusion of 0·9 p.c. saline. Next 4 p.c. formaldehyde is perfused and allowed to remain in the vessels for five minutes. This is then washed out and staining by either gentian violet or basic fuchsin or Heidenhain's iron hæmatoxylin is carried out in the same way. In the case of the latter stain, the mordant portion is first perfused and left in for ten minutes. This is washed out and the hæmatoxylin perfused and left for ten minutes. Pieces of mesentery, however stained, are excised and differentiated in watch-glasses. Dehydration, clearing and mounting are conducted on standard lines. (2) Perfusion is carried out as above but with one fluid only consisting of 17 c.cm. of saturated alcoholic solution of basic fuchsin, 63 c.cm. of absolute alcohol, 2 c cm. of glacial acetic acid, and 18 c.cm. of distilled water. This fluid is left in for seven minutes and then washed out with saline. The whole preparation is finally immersed in 4 p.c. formaldehyde to fix the dye on the nuclei. The study of the capillaries brought to view by these methods lead to the conclusion that in the mammalian mesentery the number of elements present which might be regarded as Rouget cells is insufficient to account for capillary contractility. Morphologically definable Rouget cells in the sense of specialized contractile cells closely applied to the capillary wall could not be seen. Cells and nuclei were often found in close proximity to the capillaries but such elements had none of the features of Rouget cells and appeared rather to be connective tissue elements of various types. On the other hand physiological experiments showed that the motor activity of the mesenteric capillaries of mammals resides in the endothelial cells. C. D. F.

Parathyroid and Thyroid.—D. WOODMAN ("Effect of Parathyroid Feeding on the Thyroid," *J. Physiol. Cambridge*, 1926, **61**, 557–61, 2 figs.). Administration of parathyroid produces no marked structural change in the parathyroid of rats. The thyroid of rats fed on parathyroid has an inactive appearance as shown by the increased amount of colloid present and the distension of the vesicles. C. D. F.

Golgi's Apparatus of Striped Muscles.—R. H. BOWEN ("Notes on the Form and Function of the Golgi Apparatus in Striated Muscle," *Biol. Bull.*, 1926, **50**, 108–16, 1 text-fig.). The purpose of this short but interesting paper is to draw attention to our uncertainty concerning some very essential structures in striated muscle fibres; at the same time to indicate the probable disposition of the Golgi apparatus, and to point out various possibilities which this disposition at once suggests. The whole problem must be re-examined "in order to establish the homology of the network with the Golgi material of embryonic cells, and to determine the true significance of the Q and J granules—whether chondriosomes, possible secretory granules or some as yet unrecognized combination of the two." C. D. F.

The Neurone and Neurone Junctions.—O. W. TIEGS (I) "On the Inadequacy of the Conception of the Neurone as the Unit of Conduction of the Nervous System." (II) "The Structure of the Neurone Junctions of the Spinal Cord," *Austr. J. Exp. Biol. Med. Sci.*, 1926, **3**, 45–68 and 69–79, 9 figs. each paper). The histological observations on which these two papers are based were mainly made on new-born or fœtal rabbits, guinea-pigs and kittens by means of the reduced silver methods of Cajal and Bielschowsky. The author believes that the fine collaterals, which enter the grey matter of the spinal cord, penetrate the dendrons of nerve cells, being continuous with and quite indistinguishable from the neurofibrils; they then converge towards the middle of the nerve cell body where they anastomose. From this anastomosing system a small number of neurofibrils arise and emerge through the axon. Dendrites would therefore be short structures "and the greater portion of the enormous dendrites made apparent by the Golgi method are in reality bundles of neurofibrillæ." It is suggested that the ramifying synapses of Cajal, and the superficial Golgi net of Bethe are artefacts due to coagulation and frothing of the protoplasm. C. D. F.

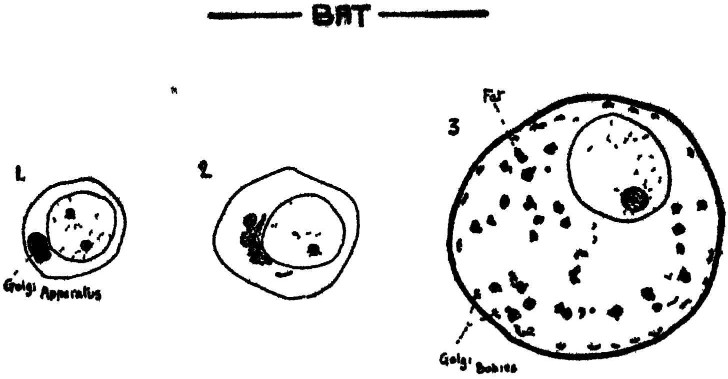
Origin of Blood-Platelets.—S. PETRI ("Investigations Concerning the Origin of the Blood-Platelets. I. Wright's Theory. II. Experimental Investigations into the Effect of Asphyxia on Blood-Platelets and Megakaryocytes. III. Experiments by a Special Bleeding Technique to Produce Isolated Influencing of Blood-Platelets and their Source. IV. Experiments to Produce an Isolated Effect on the Blood-Platelet System by means of Bleeding and Reinjection of all Constituents of the Blood excepting Blood-Platelets," *Acta Path. Microbiol. Scand.*, 1925, **2**, 21–54, 97–109, 277–86 and 357–65). The author reviews *in extenso* the question of the origin of blood-platelets of mammals and adduces considerable experimental evidence against the commonly accepted view that they are detached portions of megakaryocytes. For the histological study of the bone marrow and other hæmatopoietic organs (of mammals) he greatly recommends the following method: fix small pieces of fresh tissue in a solution consisting of 100 c.cm. of Müller's fluid and 20 gm. of corrosive sublimate; the sublimate is dissolved in the Müller's fluid by means of heat, but the crystalline deposit which forms after cooling should not be removed. After 24 hours the pieces are washed overnight under the tap, and then embedded in the usual way. Supposedly after removal of the excess of sublimate by means of iodine, the sections are stained for 6–8 minutes in a saturated solution of Wright's powder in chemically pure methyl alcohol (about 10 ctgm. in 60 gm.) diluted with distilled water (1 : 1) immediately before use. The staining solution should be 4–14 days old. Rinse the sections in water; blot with filter-paper; dehydrate in acetone, clear first in acetone 1 p. + turpentine 9 p. and then in turpentine; mount in colophonium dissolved in turpentine.

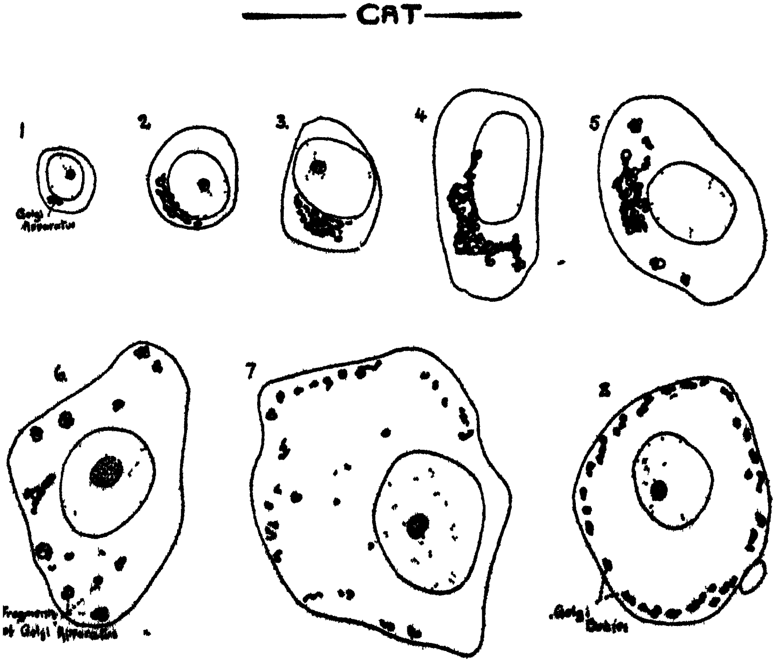
A. P. and C. D. F.

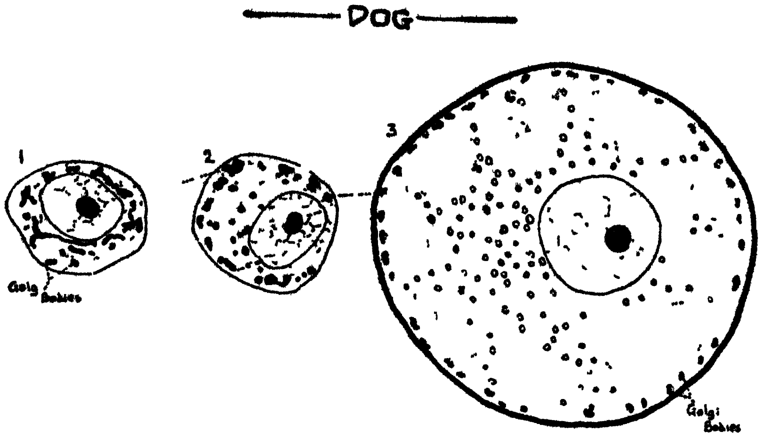
Auditory Apparatus of Talpa.—H. C. WILKIE ("The Auditory Apparatus of the Common Mole, *Talpa europæa*," *Proc. Zool. Soc.*, 1925, 1281–92, 5 text-figs.). A full anatomical description with figures of the ossicles. Attention is drawn to the remarkable incus, the relatively large size of the tympanum, the stapedial artery, and the communication between the oblique and horizontal semicircular canals. The labyrinth was studied by ordinary dissection methods both with and without decalcification as well as by Gray's corrosion method. For the histological investigation of the inner ear Tafani's fixing fluid of "bichromate of potash and hyperosmic acid" is particularly recommended. Very satisfactory results are obtained also by the use of Vlakovic's fluid. This consists of 1 part of a 5 p.c. aqueous solution of chromic acid and 16 parts of 90 p.c. alcohol. After 24 hours the material is passed into alcohol and then decalcified. E. W. B.

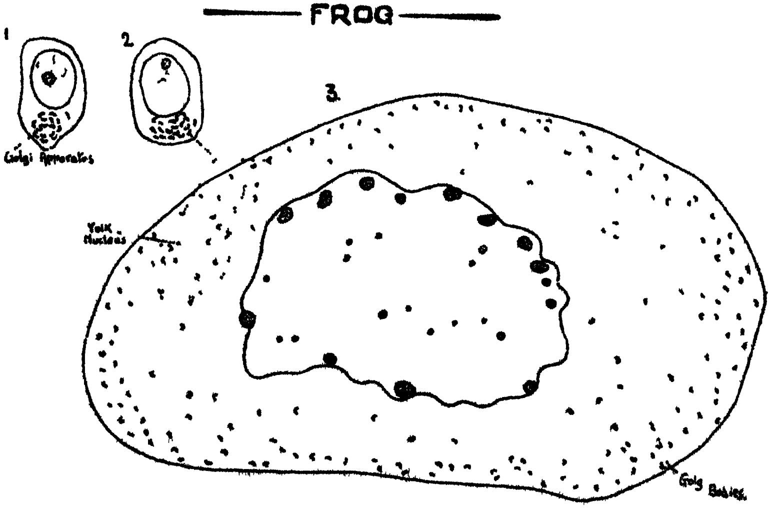
Blood Capillaries of Motor Plates.—R. NOEL ("Sur un dispositif vasculaire spécial observé au niveau des plaques motrices," *Bul. hist. appl. physiol. path.*, 1926, **3**, 33–6, 2 figs.). In specimens from the cat's tongue fixed and stained by Regaud's method for mitochondria one can see that each motor plate is in part surrounded by a blood capillary which on reaching the plate bifurcates. This arrangement appears to be constant. C. D. F.

Golgi Apparatus during Oogenesis.—P WEINER ("Der Golgische Apparat bei der Ovogenese," *Ztschr. f. mikrosk. anat. Forsch.*, 1926, 4, 149–62, 2 pls.).









Figs. more diagrammatic than originals, and schematised.
R. J. L.

Nasmyth's Membrane.—S. W. Chase ("The Origin, Structure and Duration of Nasmyth's Membrane," *Anat. Rec.*, 1926, **33**, 357–76, 8 text-figs.). The Nasmyth membrane is derived from remains of the entire enamel organ, with the exception of the enamel pulp, together with overlying cells from the gingival epithelium. It consists of two parts: (1) an inner pellicle formed of the fused cuticular borders of the ameloblasts; (2) an outer cellular portion composed of remains of the enamel organ and cells from the gingival epithelium. The markings on the pellicle, formerly called impressions of the ends of enamel prisms, are remains of detached portions of enamel adherent to the pellicle. Other markings, similar in appearance but on the other side of the pellicle, are produced by remains of the ameloblasts. The Nasmyth membrane is a transient structure, in the majority of cases destroyed during the early stages of eruption. No remains of the membrane are found on adult teeth, but a bacterial film simulating it can be found in about 80 p.c. of extracted human teeth and on practically all teeth of dogs, rabbits and calves. C. D. F.

Transitional Epithelium.—A. Brauer ("The Regeneration of Transitional Epithelium," *Anat. Rec.*, 1926, **33**, 187–46, 4 text-figs.). Observations on the normal epithelium of the urinary bladders of cats and sheep. The mitotic figures were noted and recorded as to the stratum in which they occurred and the plane of division. They were found regularly in all cells from the basal layer up through the central strata until the cells showed signs of degeneration in the most superficial layers. In all cases, with the exception of one, viz. that of a much distended bladder, at least 50 p.c. of the cell divisions were found in the central layers. The long axes of the mitotic spindles were most frequently so directed that the division plane of the cells was at right angles to the surface and not parallel to it. The divisions do not, therefore, directly cause a movement upward of the more basal cells. A gradual movement towards the superficial layers in transitional epithelia, is not due, as generally admitted, by mitosis in the deeper strata, but by the growth and division of the cells of almost all layers and the subsequent crowding thus produced by them. C. D. F.

Basophilic Granulocytes.—H. E. Jordan ("On the Nature of the Basophilic Granulocytes of the Blood and the Tissues," *Anat. Rec.*, 1926, **33**, 89–106). The evidence to date does not adequately support the claim of a sharp distinction between blood and tissue basophilic granulocytes (mast-leucocytes and mast-cells respectively), except in the sense of difference of mode of origin. Also the specificity of mast-leucocytes and eosinophils seems to the author doubtful. In his opinion the available evidence is more in favour of the interpretation of basophilic leucocytes as unripe, only partially ripe or abortive degenerate eosinophils; and the double and interchangeable origin of eosinophils and special granulocytes from lymphocytes or young connective tissue.
C. D. F.

Interstitial Cells of Striped Muscles.—R. Noel ("A propos des cellules dites 'interstitielles' décrites par Thulin dans certain muscles," *Bul. hist. appl. physiol. path.*, 1926, **3**, 1–9, 4 figs.). In 1909 Thulin observed among the fibres of certain striped muscles (chiefly diaphragm of rabbits) certain large granular cells which he termed sarcosomocytes, being in his opinion histologically and physiologically identical with Holmgren's trophocytes. Now Noel points out that Thulin's interstitial cells are only portions of the so-called sole of motor muscle-plates cut tangentially. C. D. F.

γ. General.

Lymph-Glands after Splenectomy.—A. Luzzatto ("Funzione emocateretica delle ghiandole linfatiche delle cavie splenectomizzate," *Hæmatologica*, 1926, **7**, 383–6). In guinea-pigs the most striking effect of splenectomy on lymph-glands is an alteration in the mode of phagocytosis of red corpuscles by the reticulo-endothelial cells of the glands. Normally erythrocytes are ingested by these cells in a form in which they are still recognizable as red corpuscles, but, after splenectomy, there are three stages in the process, viz. (1) agglutination of the red corpuscles in the peripheral zone of the reticulo-endothelial cell; (2) break-down of the corpuscles into a structureless and amorphous mass; (3) incorporation of this material into the cytoplasm of the reticulo-endothelial cell. A. P.

Fœtal Thyroid and Pituitary.—P. Rumph and Phil. E. Smith ("The First Occurrence of Secretory Products and of a Specific Structural Differentiation in the Thyroid and Anterior Pituitary during the Development of the Pig Fœtus," *Anat. Rec.*, 1926, **33**, 289–98, 5 text-figs.). Follicle and colloid formation is evident in the thyroid of the 9 cm. pig fœtus but is absent in the thyroid of the 7 cm. fœtus. The cells characteristic of the anterior lobe of the pituitary body are not present in the 14 cm. fœtus and only a few are present in the 16 cm. stage. They are numerous in the 26–28 cm. fœtus. C. D. F.

Testis and Thyroid in Hen-Feathered Cock.—G. W. Buchanan ("The Testis and Thyroid in a Hen-Feathered Silver-grey Dorking Cock," *Brit. J. Exp. Biol.*, 1926–27, **4**, 73–80, 2 pls.). A case is described of an apparently normal silver Dorking cock becoming hen-feathered. The endocrine glands of this bird were examined and the testes and thyroid found to be distinctly abnormal. The testes showed large masses of luteal cells, abnormal spermatogenesis and non-functioning tubules. In the thyroid a myxœdematous and cystic condition was observed. The testes and the thyroid of two Sebright bantams, which are normally hen-feathered, were then examined. The testes were normal, without luteal cells; the thyroid was small, relatively rich in connective tissue with poorly developed secreting vesicles; also the blood supply was scanty, suggesting that the Sebright thyroid is subnormal in activity. According to the author these observations suggest that an under-functioning thyroid may be a controlling factor in hen-feathering, either by acting in combination with the gonad secretion or by altering it. C. D. F.

Suprarenal Gland during Pregnancy.—Y. Tamura ("Structural Changes in the Suprarenal Gland of the Mouse during Pregnancy," *Brit. J. Exp. Biol.*, 1926–27, **4**, 81–92, 2 pls.). In the mouse there is no correlation between body weight, body length and size of the suprarenal gland. Unilateral ovarioctomy has no effect on its functional activity. During pregnancy the zona glomerulosa becomes hypertrophic and reaches its maximal secretory activity at the 17 mm. stage. The observations on the hypertrophy of the zona fasciculata are in agreement with those of other authors. The hypertrophy may be due either to an enlargement of cells or to an increase in their number. This zone also reaches its maximal activity at the 17 mm. stage when the so-called siderophile bodies (secretory granules) are visible in great numbers. The zona reticularis degenerates rapidly at an early period of pregnancy, viz. before the formation of the placenta; at the middle of pregnancy the site of this zone is occupied by vacuoles. The hypertrophy of the medulla occurs at the closing period of pregnancy. Mitotic figures are observed in every zone with the exception of the zona reticularis at an early period of pregnancy. The secretory activity of the gland decreases towards the end of pregnancy. C. D. F.

High Flanker Testis in Cattle.—T. H. Bissonnette ("The 'High Flanker' Testis in Cattle, with its Bearings on the Problem of the Scrotum and on that of the Freemartin Testis," *Anat. Rec.*, 1926, **33**, 47–58, 4 text-figs.). In cattle, testes which have descended through the inguinal canal, but have not passed into the scrotum completely and remain embedded in the loose connective tissue in the angle between the thighs at the base of the scrotum are called "high flankers" by the veterinarians. They are smaller than normal testes and the epididymis is abnormal in size and relation to the gland. The histological examination of one of these testes has led the author to the conclusion that the high-flanker testis is a typical cryptorchid testis. It is very like the freemartin testis retained in the abdomen but with larger tubules and Sertoli cell nuclei, and more abundant interstitial cells. Spermatogonia are rare. C. D. F.

Testis of Xiphophorus Helleri and Secondary Sex Characters.—G. J. van Oordt ("The Relation between the Development of the Secondary Sex Characters and the Structure of the Testis in the Teleost *Xiphophorus Helleri* Heckel," *Brit. J. Exp. Biol.*, 1925–26, **3**, 43–59, 3 text-figs.). (See for a previous paper by the same author on the testis of Stickleback, this Journal, 1925, **45**, 342.) Only the development of the most conspicuous sex characters, viz. the gonopod and the sword, were considered in relation to spermatogenesis in the Cyprinodont fish *Xiphophorus Helleri*. The testis of the young immature male, in which the secondary sex characters have not yet developed, contains only a small number of primary spermatogonia besides many tubules derived from the peritoneal epithelium. Simultaneously with the beginning of the transformation of the anal fin into an intromittent organ, spermatogenesis starts and at the same time the epithelium of these tubules is transformed into germ cells which are situated in small cysts. When the spermatogenesis has reached the formation of spermatocytes, the elongation of the caudal fin has generally started. The testis of the male in which the gonopod is fully developed, but of which the sword has not reached its maximum length, contains all stages of spermatogenesis up to spermatophores, but the latter are still found in the cysts. In the fully mature male the spermatophores are lying in great numbers in the sperm ducts. C. D. F.

Gonad Grafts in the Fowl.—A. W. GREENWOOD (*Brit. J. Exp. Biol.*, 1925, **2**, 469–92, 4 pls.). This paper deals with the histology of material from nineteen cases of gonad grafts in fowls from the series of transplantation experiments performed by Finlay (this Journal, 1926, **46**, 129). While some of the ovary grafts remain typically ovarian, many show a secondary proliferation of the sex cords and their further differentiation into tubules of a spermatic type. Most of the testis grafts are either in active spermatogenesis or are composed of some active and some atrophic tubules. Islets of typical luteal cells are present in the interstices between the inactive tubules in the testis grafts and are not associated with a henny plumage. In ovarian grafts luteal tissue is found in normal situations and also among the undifferentiated sex cords and tubules. The new proliferation of the sex cords in the ovarian grafts may be derived from the germinal epithelium and also from the intra-ovarian epithelial elements represented by the degenerating medullary cords. C. D. F.

Embryonic Tissues growing in vivo and in vitro.—T. S. P. STRANGEWAYS and H. B. FELL ("Experimental Studies on the Differentiation of Embryonic Tissues growing *in vivo* and *in vitro*. (I) The Development of the Undifferentiated Limb-Bud (*a*) when subcutaneously grafted into the Post-Embryonic Chick and (*b*) when cultivated *in vitro*. (II) The Development of the Isolated Early Embryonic Eye of the Fowl when cultivated *in vitro*," *London, Proc. R. Soc.* (B), 1925–26, **99**, 340–66, 9 pls., 1 text-fig., and 1926, **100**, 273–83, 2 pls., 2 text-figs.). (I) The undifferentiated limb-buds of fowl embryos of 82 hours' incubation were inoculated subcutaneously into the under-surface of the wings of post-embryonic chicks. The grafts grew well and differentiated into cartilage, bone, fibrous tissue and typical epidermis; differentiated muscle was absent. The general morphology of the skeletal tissue in the grafts bore apparently no relation to that of the normal limb-skeleton. Similar limb-buds were cultivated *in vitro* by means of an improved tube technique; the explants showed active cell-division and cartilage; white fibrous tissue and typical epidermis differentiated during cultivation. When grown in a relatively fluid medium many cultures developed into balloon-like cysts; in such cases the shape and arrangement of the cartilaginous nodules showed no correspondence with the structure of the developing cartilage-bone of the normal limb. When a more solid medium was employed cyst-formation was far less pronounced, and the skeletogenous tissue frequently showed the early stages in the development of a normal limb-skeleton. (II) The eyes of fowl embryos of 64–72 hours' incubation were cultivated *in vitro* by the above technique. The explanted eyes showed remarkable powers of self-differentiation. Pigment, rodes and cones, inner and outer nuclear layers, inner and outer plexiform layers, ganglion cells and nerve fibres, the *pars ciliaris retinae* and the fibres of the lens developed during cultivation. Differentiation in its latter stages proceeded *in vitro* at almost the normal rate, though the cultures obtained a maximum size of only 1–2 mm. From this it appears that inhibition of normal cellular multiplication is not necessarily correlated with inhibition of normal tissue differentiation. C. D. F.

Placental Remnants in Cavia.—N. H. W. Maclaren ("The Early Development of Cavia: Note on Associated Remains of Previous Placentation," *London, Proc. R. Soc.* (B), 1925–26, **99**, 230–1, 1 pl.). While investigating the early development of Cavia the author observed a numerous group of structures which varied a good deal both in size and in character, but could all be shown to be placental fragments from the previous pregnancy. Some of them bore a great similarity to actual embryos. They do not seem to have been previously recognized in Cavia, and their possible presence in the same uterus as normal embryos necessitates careful discrimination. C. D. F.

The Cytology of Tar Tumours.—R. J. Ludford (*London, Proc. R. Soc.* (B), 1925, **98**, 557–77, 34 text-figs.). The author has studied the cellular anatomy of tumours produced by painting the skin of mice with tar. During keratinization of epidermal cells the Golgi bodies if originally grouped together, become scattered throughout the cytoplasm and finally cease to be demonstrable by osmic acid methods. When the dispersal of the apparatus is retarded, it may be recognized during the formation of keratohyalin from nuclear extrusions. Cell hypertrophy is of common occurrence; the hypertrophied cells have larger and more numerous Golgi bodies; mitochondria also increase in number. During degeneration the former break up into granules and the latter become vesicular and then fail to stain. Where epidermal cells are in contact with the dermis or a well-developed stroma, the cytoplasmic organs acquire a polarized distribution. Hypertrophy of the sebaceous glands is a marked feature of the thickened epidermis surrounding tar-tumours; the fatty secretion of their cells appears in intimate relation with the Golgi bodies. Fibroblasts and endothelial cells, especially of the more malignant tumours, exhibit marked hypertrophy during which the Golgi bodies increase in number and anastomose to form a network; this breaks up during degeneration. Penetration of the panniculus carnosus by the tumour cells induces reaction on the part of the muscle fibres. Their sarcoplasm increases in quantity and their nuclei in number; the mitochondria become more numerous and the Golgi bodies proliferate and spread throughout the sarcoplasm. C. D. F.

Tar-Tumours.—L. Kreyberg ("Malignant Tar-Tumours in White Mice," *Acta Path. Microbiol. Scand.*, 1925, **2**, 141–48, 5 pls., 1 text-fig.). Eighteen malignant tar-tumours of the skin of white mice were examined. The epithelium of the tumours varied from the well-differentiated squamous cell type to "a most atypical and undifferentiated epithelium." In some tumours and their secondary nodules groups of definitely spindle-shaped cells were observed, which the author also regarded as highly atypical epithelial cells. C. D. F.

B. INVERTEBRATA.

General.

Micro-Injection Studies.—J. and D. M. NEEDAM ((I) "The Hydrogen-ion Concentration and the Oxidation-Reduction Potential of the Cell-Interior." (II) "The Hydrogen-ion Concentration and the Oxidation-Reduction Potential of the Cell-Interior before and after Fertilization and Cleavage." (III) "Further Micro-Injection Studies on the Oxidation-Reduction Potential of the Cell-Interior," *London, Proc. R. Soc.* (B), 1925, **98**, 259–86, 7 text-figs., and 1925–26, **99**, 173–99 and 383–97, 2 text-figs.). (I) Experiments were made by means of a micromanipulator similar to that described by Chambers. *Amœba proteus* was chosen as the most suitable material. Its cell-interior was estimated to have a H-ion concentration of about pH 7·6. Injections were made of 1 – naphthol, 2 – sulphonic acid indophenol, usually in the completely oxidized form, into the amœba and the resulting colour compared with that of samples of a known degree of reduction. This indicator showed in the cell an equilibrium position at 15 to 30 p.c. reduced, viz. an oxidation-reduction potential of between rH 17 and 19. (II) The internal pH of the eggs investigated (3,300 in all and comprising specimens from four echinoderms, one tunicate and one polychæte worm) is in the close neighbourhood of 6·6. It does not change on fertilization and is constant as far as the 16 cell stage. It is not affected by local injury nor by the morphological degeneration produced in asphyxia until cytolytic stages are reached. On cytolysis the pH is lowered to a point below 5·(and above 4·0. The rH of the eggs studied varies more than the pH but within the limits of 19 to 22; it does not change on fertilization and is constant as far as the 8 cell stage; it does not alter on cytolysis. These results demonstrate the service which the method of micro-injection can perform in overcoming two important difficulties inherent in vital staining. Firstly, substances to which the normal cell-wall is impermeable can be introduced into the cell with little or no injury; secondly, owing to the rapidity of the method and the minute amount of dye necessary, there is far less danger of an upsetting of the original equilibria and the establishing of unnatural ones. (III) Oxidation reduction potential indicators exhibit no anomalies when injected into *Amœba proteus*. It appears, therefore, that all the dyes at present in use on the rH scale may be employed with biological material. The amœba is capable of oxodizing the leuco-form of indicators of lower oxidation-reduction potential than its own. C. D. F.

Mollusca.

a. Cephalopoda.

The Deep-Sea Octopoda.—G. C. ROBSON (*Proc. Zool. Soc.*, 1925, 1323–56, 4 text-figs.). The following conclusions as to the general structure of the deep-water Octopoda were reached. The integument tends to become gelatinous and the musculature to be reduced. The mantle aperture is usually narrow and in some forms almost entirely closed. The gills are reduced in area and number of filaments as well as by atrophy of the inner demibranch. The vascular system appears to be modified only in the venous organization of the *Cirroteuthidæ*. The heart is generally normal. The special glands (white body, branchial heart) are not as a rule considerably modified. Histologically the glands of abyssal forms do not differ from those of surface species with the exception of the white body, the cells of which are more granular than in the littoral and surface forms. In the digestive system the radula is atrophied, the mandible is nearly always normal, the crop is almost entirely absent or reduced in size and a third stomach is present in some of the *Cirromorpha*. The ink-sac is atrophied. The eyes tend to become enlarged; atrophy of the eyes and telescopic vision are very rare. Light organs are also rare. The development of the chromatophores is apparently independent of depth. C. D. F.

γ. Gastropoda.

Velar Cilia of Nudibranch Veliger.—G S. CARTER ("On the Nervous Control of the Velar Cilia of the Nudibranch Veliger," *Brit. J. Exp. Biol.*, 1926–27, 4, 1–26, 3 pls.). The larvæ of the Nudibranchs *Archidoris tuberculata*, *Aeolis drummondi*, *Aeolidia papillosa*, and *Doto coronata* were used. Their structure differs only in details regarding the relative size and number of the cells and their parts, and no separate description is given of each. The velum consists of the ciliary apparatus and the nervous apparatus. In the former the following parts are recognized: (1) The cilium; this is formed of a series of triangular plates set one behind the other in the plane of the beat of the cilium; each plate is associated with a pair of basal granules within the cell, one below each of its two external sides; the plates increase in length towards the side of the cilium which is hindmost in the effective beat; two, four or even more cilia are born on each cell. (2) The ciliary apparatus within the cell; this consists of: a double row of basal granules below each cilium, each containing about fifteen basal granules; an area around the basal granules which stains with hæmatoxylin but less than the granules themselves; an area of differentiated protoplasm lying between the basal granules and the nucleus; an area of protoplasm containing granules which stain with methylene blue and which are situated on a level with the nerve endings. The nervous apparatus is formed of: fibres which pass up between the cells from their bases to the level of the granules stained by methylene blue; finer fibrils into which the fibres break up at this level; rod-like organs which occur on the course of the fibrils. The beat of the cilia is intermittent, and from the results of various experiments the author concludes that the intermissions are regulated by the nerve endings above mentioned and that the beat of the cilia is, therefore, controlled by the nervous system of the animal. C. D. F.

Radula of American Snails.—H. A. PILSBRY ("The Land Mollusks of the Republic of Panama and the Canal Zone." *Philadelphia Proc.*

Acad. Nat. Sci., 1926, **78**, 57–126, 40 figs., 2 pl.). In an appendix the author discusses the classification of related forms examined in the course of determining the Panamic species of *Thysanophora*. In *Lacteoluna* n. gen., the radula shows 9.10.1.10.9. teeth with short square centrals with the mesocone nearly as long as the basal plate; ectocones well developed; laterals similar but without entocone. In the marginal teeth an entocone is developed by splitting of the mesocone, and the original ectocone is bifid or split into three cusps. In *Suavitas* n. gen., there are ?.14.1.14.? teeth (the number of the externals not being ascertained owing to the persistent curling of the radula), those of the median field decidedly longer than wide, with long stout mesocones. On the second lateral, or in worn teeth much further out, a minute ectocone appears, and about the 16th a minute endocone, high on the mesocone. The marginal teeth are low, wide with the endocone large, sometimes bifid; ectocone represented by two or three denticles. In *Thysanophora hornu* the radula has 8.8.1.8.8. teeth. The centrals are tricuspid, laterals bicuspid. The marginals have a long simple inner cusp (mesocone) and three to four ectocones. In the absence of endocones on both lateral and marginal teeth this radula resembles that of *Microphysula*, and differs from *Hojeda* and *Lacteoluna*. H. B. Baker's figure of *Hojeda* is reproduced. E. W. B.

Genital Organs of Vitrea.—G. MERMOD ("Anatomie des organes reproducteurs de *Vitrea diaphana* var. *subrimata* Rhein. et *Vitrea crystallina* var. *andreæi* Bttg.," *Rev. Suisse Zool.*, 1926, **33**, 561–7, 5 figs.). Typical *Vitrea diaphana* Stud., not possessing an umbilicus does not seem to occur in Switzerland. The form described by Rheinhardt as having a small umbilicus is however common, and it is probable that this is what Studer really meant, though forms without an umbilicus are found in Germany. The author describes for the first time the genitalia of the form *subrimata*. The vagina possesses no trace of glandulæ vaginales. The erectile organ (sarcobelum) has two nearly parallel rows of spines. It does not appear likely that the specimens examined were immature *Vitrea crystallina* from near Geneva was also examined. Here there is a thick spongy group of glandulæ vaginales surrounding the vagina, and the spines of the sarcobelum are in a single row. Mermod thinks that the object of this organ is to maintain the erection of the penis when evaginated; it is less likely that it serves as a mould for the spermatophore, since in both these species the spermatophore is smooth and undecorated. He desires confirmation of the persistent absence of glandulæ vaginales in *V. diaphana*. E. W. B.

Radulæ of Vertigo.—G. MERMOD ("Notes systématiques sur quelques espèces arctico-alpines de Vertigo," *Rev. Suisse Zool.*, 1926, **33**, 568–76, 6 figs.). In the course of studies designed to clear up the synonymy of this group, Mermod skilfully removed the animal from a type specimen of *V. sumicra* Cless., without damaging the shell. This radula is described and figured; it has the following formula:—

$$\frac{1}{2}+\frac{4}{5}+\frac{1}{3}+\frac{8}{3}+\frac{M}{3}+\frac{8}{3}+\frac{1}{3}\times\frac{4}{5}+\frac{1}{2}\times 105 \text{ approx.}$$

Figures are also given of the radulæ of *V. arctica* Wallb., formula :—

$$\frac{M}{3}+\frac{8}{3}+\frac{1}{3}+\frac{3}{5}+\frac{2}{?};$$

V. alpestris Ald., formula :—

$$\frac{M}{3}+\frac{7}{3}+\frac{1}{3}+\frac{2}{4}+\frac{1}{4\text{-}6}+\frac{2}{?}\times 100 \text{ approx.};$$

V. parcedentata Br., formula :—

$$\frac{M}{3}+\frac{5\text{--}6}{3}+\frac{1}{3}+\frac{4\text{--}5}{5}+\frac{1}{2}\times 90 \text{ approx.}$$

The last three formulæ only describe one pleura each. Mermod subdivides the types of teeth more minutely than usual by taking account of the transitional row and of the external imperfect rows separately. The difficulty of this work can best be appreciated by those who have attempted it themselves, while an additional value is given to Mermod's research by the fact that he made his observations on authenticated type specimens. E. W. B.

Arthropoda.

α. Insecta.

Follicle Cells of the Cricket-Egg.—M. R. MURRAY ("Secretion in the Amitotic Cells of the Cricket Egg Follicle," *Biol Bull.*, 1926, **50**, 210–4, 3 pls.). The species of cricket used for study were: *Gryllus abbreviatus* and *Nemobius fasciatus*. The amitotic appearance of the nucleus of the follicle cells surrounding the egg is regarded as an adaptation to the secretory activity of the cell, having as its main function the increase of nuclear and nucleolar surface. Droplets of a fatty nature are elaborated by the follicle cells and passed in large numbers into the hæmocoel of the insect. The mitochondria of the follicle cells represent an intermediate stage between lipoid granules appearing in the nucleus of the follicle cell and lipoid granules surrounding the yolk globules of the egg. No inclusions corresponding to current descriptions of Golgi bodies were observed either in the eggs or follicle cells. R. J. L.

β. Crustacea.

Spermatogenesis of the Black-Clawed Crab.—N. FASTEN ("Spermatogenesis of the Black-Clawed Crab, *Lophopanopeus bellus* (Stimpson) Rathbun," *Biol. Bull.*, 1926, **50**, 277–92, 3 pls.). The spermatogonial chromosomes are univalent and are probably 124 in number. Large nutritive cells are frequently associated with spermatogonial strips in tubules containing mature spermatozoa. These have large nuclei and are derived from primary spermatogonia which have failed to mature. The primary spermatocyte undergoes growth, parasynapsis, tetrad formation and reduction division. During the growth period a chromatoid body appears in the cytoplasm and when reduction division takes place this wanders undivided to one pole so that the secondary spermatocytes are of two kinds : one with and one without the chromatoid body. The division of the secondary spermatocytes is equational and produces two types of spermatids, one with and one without the chromatoid body. The spermatids without this body are about three times as numerous as those which possess it. At an early stage the chromatoid body is expelled, and from then all spermatids undergo similar transformations. The mature spermatozoa are radial and may be three-, four-, five- and six-rayed. C. D. F.

Oogenesis in Oniscus Asellus.—S. D. King (*London, Proc. R. Soc.* (B), 1926, **100**, 1-10, 2 pls.). Yolk is of two kinds, one directly derived from the mitochondria, the other from the Golgi bodies. The mitochondrial yolk is at first rather diffuse, then retreats to a zone around the nucleus and then passes outwards to a peripheral zone. The Golgi yolk is evenly distributed through the cytoplasm. The mitochondria are at first scattered, then tend to collect round the nucleus; later they become scattered again. The Golgi bodies are concentrated near the nucleus in the young oocyte, and later pass out through the cytoplasm, where many of them swell up to form yolk spheres. The oogonia and youngest oocytes are basophil, but the latter become oxyphil early in their development and remain so until the close of oogenesis. Nucleolar activity is apparently absent in Oniscus. C. D. F.

Dorsal Organs of Argulus.—M. L. Pyatakov ("The Dorsal Organs of *Argulus* and their Relation to the Hatching of the Larva," *Quart. J. Microsc. Sci.*, 1926, **70**, 159–71, 10 text-figs.). Till the moment of hatching there appear successively two dorsal organs and two cuticles. The first dorsal organ, stripe-like, stretches along the dorsal region of the embryo. After its disappearance there remains in the first cuticle a seam or suture. But before it has disappeared out of its hind end, the second dorsal organ arises. This produces a sticky substance, which spreads over the second cuticle, particularly in the dorsal region of the embryo. At the moment of hatching, this cuticle, including the embryo, swelling up as a vesicle, serves as an active mechanism to split the covering along the seam mentioned above and to open widely the resultant valves. C. D. F.

Hepato-Pancreas of Ligia.—D. M. Patrick ("An Experimental Study of the Cells of the Hepato-Pancreas of Ligia," *Brit. J. Exp. Biol.*, 1926–27, **4**, 27–37, 1 pl.). In the tubules of the hepato-pancreas of *Ligia oceanica* two different and distinct kinds of cells are present; the one of large size and columnar shape and containing fat droplets; the other consisting of smaller oval or wedge-shaped cells; these are less numerous than the former and are filled with granules of mucigen. In all cases the cells are enclosed in a thin envelope of chitin and, therefore, do not form a syncytium. The changes produced in these cells by fatigue, pilocarpine and strychnine are described. Pilocarpine acts powerfully on the columnar cells but leaves the oval ones unaffected.

C. D. F.

a. Oligochæta.

Nephridia of Woodwardia.—K. N. Bahl ("The Enteronephric System in *Woodwardia*, with Remarks on the Nephridia of *Lampito dubius*," *Quart. J. Microsc. Sci.*, 1926, **70**, 113–34, 2 pls., 2 text-figs.). Essentially the nephridial system of *Woodwardia* resembles that of *Lampito*; both possess the enteronephric septal nephridia and the exonephric integumentary nephridia. The bunches of pharyngeal nephridia open into the pharynx and buccal cavity through five or six pairs of common ducts. The elaborate system of canals and ducts characteristic of the excretory system of *Pheretima* and *Lampito* obtains in *Woodwardia* as well, but the physiological significance of the system still remains uncertain. The nephridial system of *L. dubius* consists of a pair of clusters in each segment, each cluster comprising five nephridia with five pre-septal funnels and each member of the cluster opening separately to the exterior. Stephenson's idea of a meganephridium with branching funnel is, according to the author, erroneous; if each cluster is derived by branching from a single meganephridium of *Lumbricus* the branching is not confined to the funnels only, but has been completed from one end of the nephridium to the other, and each of the five nephridia in a cluster, is a separate and discrete structure.

C. D. F.

Gastrotricha.

New Aberrant Gastrotricha from Kiel Bay.—A. Remane ("Neue aberrante Gastrotrichen I; Macrodasys buddenbrocki nov. gen. nov. spec. (1. Beitrag zur Fauna der Kieler Bucht.)," *Zool. Anz.*, 1924, **61**, 289–97, 2 text-figs.). The number of Aberrant Gastrotricha hitherto known is very scanty, comprising only four genera, each represented by a single species. Remane now announces the discovery of eight new forms, of which one belongs to the genus Turbanella M. Schultze and seven are representatives of new genera. They have been found in material collected during numerous marine excursions about and beyond Kiel Bay under the direction of Prof. v. Buddenbrock of the Zoological Institute of the University of Kiel. In this first paper the author describes *Macrodasys buddenbrocki* nov. gen. nov. spec., which is noteworthy among many other characteristic details for its great size, being 1·2 mm. long, or about twice as long as any other Gastrotrichan on record. It is hermaphrodite and the male organs are developed in advance of the female.

D. B.

Echinodermata.

Amœbocytes with Spherules.—J. B. Kindred ("A Study of the Genetic Relationships of the Amebocytes with Spherules in *Arbacia*," *Biol. Bull.*, 1926, **50**, 147–54, 3 text-figs.). According to St. Hilaire

(1897) the cells of the perivisceral fluid of the echinoids can be classified thus:—(1) small leucocytes with neutrophilic granules; (2) larger leucocytes devoid of granules; (3) amœbocytes with basophilic spherules; (4) amœbocytes with acidophilic spherules; (5) amœbocytes with green spherules. Kindred now deals with the possible origin of amœbocytes with spherules from the leucocytes. He points out that the amœbocytes of the fresh perivisceral fluid of *Arbacia* contain either colourless or red or yellow spherules. In fixed and stained smears the colourless spherules are amphophilic to basophilic and the red spherules are acidophilic; the yellow spherules present no definite tinctorial reactions, but some of them appear to be faintly acidophil. From these observations and from others made in stained sections of the intestinal wall of *Arbacia*, the author comes to the conclusion that the basophil spherules are food droplets ingested by leucocytes and stored into vacuoles which give an acid reaction to neutral red. Subsequently the spherules appear to shrink in size and become alkaline in nature; hence their change in colour reaction from basophil to acidophil; the yellow spherules would be the end product of the red ones. C. D. F.

Rotatoria.

The Rotifers and Entomostraca of the River Oka.—K. Neisvestnova-Zhadina ("Zooplankton r. Oki pod g. Muromom po sboram, 1919–22, g. g.," *Rabot Okskoi Biol. Stantsii*, 1924, **3**, 1–45). A summary of the Rotatoria and Entomostraca obtained from Plankton collections made in the central stream of the River Oka at Murom, during the years 1919–22, to determine the quality and condition of the water there. In all 94 species of Rotatoria and 47 species of Entomostraca (36 Cladocera and 11 Copepoda) are listed. They are arranged in groups according to their periodicity, the importance of their numbers and the frequency of their appearances. The most important rôle is played by the Rotatoria of which no less than 17 species are placed in the highest group as against only 2 species of Entomostraca. On the whole the Planktonal succession reproduced itself year by year. Among the forms thus found are many which are exceedingly rare although no new species are described. D. B.

Unrecorded or little-known Rotifers in Germany.—Richard Leissling ("Zur Kenntnis einiger in Deutschland bisher wenig oder nicht bekannter Radertierarten," *Schr. Süssw. Meeresk.*, 1924, Heft 3, 1–8, 5 text-figs.). The author gives a description of *Taphrocampa saundersiae* Gosse, hitherto unrecorded for Germany, but found by him in several localities in the vicinity of Zeitz in Saxony. In this district were also found *Microcodides robustus*, *Brachionus quadratus rotundus* and a new *forma* of *Brachionus quadratus tridentatus* Sars, which he names *forma tripartitus*. From the vicinity of Landsberg he describes *Brachionus urceus* var. *Bennini* var. n. He now considers that *Brachionus similis*, described by him in 1914, should not rank as distinct, but rather be ranged in the variation-series of *Brachionus budapestinensis*. D. B.

Proales gigantea in Russia.—A. D. NEKRASOV ("K rasprostranenii͡u i biologii kolovratki Proales gigantea Glaskott, parazitirui͡ushchei v i͡aitsakh prudovikov (Lymnæa)," *Russ. Hidrob. Zhurn.*, 1925, **4**, 184–9, 1 pl.). Having found, in the river Kljasma (about 20 km. from Moscow), eggs of Lymnæa attacked by the very rarely detected rotifer, *Proales gigantea*, Nekrasov has been able to watch the manner in which this tiny animal pierces through the membranous and slime-covered skin of the egg by repeated blows of the trophi used hammerwise until a small opening is made and enlarged sufficiently to permit its entrance. The operation frequently takes as long as an hour. Hitherto this rotifer has been definitely known only from Ireland and from England.

D. B.

Parasitic Rotifers.—ERNST BUDDE ("Die parasitischen Rädertiere mit besonderer Berücksichtigung der in der Umgegend von Minden i. W. beobachteten Arten," *Zs. Morph. Ökol. Tiere*, 1925, **3**, 706–84, 27 text-figs.). To descriptions of some twelve species of Rotatoria addicted to one or other of the various forms of parasitism and found in the vicinity of Minden i. W., the author has added a survey of all Rotatoria, which are known or have been alleged to be parasitic in one degree or another either on other animals or on plants, whether internally or externally. The list extends to no less than fifty-five species. Among the species specially studied are *Proales wernecki*, *P. parasita*, *P. petromyzon*, *Callidina parasitica*, *C. socialis*, and *C. magna-calcarata*. The growth of the galls in Vaucheria, induced by *Proales wernecki*, only begins when the rotifer, having already gained entrance to the hollow tube of the Vaucheria and wandered about therein eating the protoplasmic lining, lingers sufficiently long at one spot, and only continues whilst the animal remains feeding within the gall. Growth ceases if the animal abandons the gall. Thus is explained the presence of several half-grown and unoccupied galls near a well-grown and tenanted gall.

D. B.

The Rotiferan Genera Lecane and Monostyla.—H. K. HARRING and F. J. MYERS ("The Rotifer Fauna of Wisconsin, III.: A Revision of the Genera Lecane and Monostyla," *Trans. Wis. Acad. Sci. Madison*, 1926, **22**, 315–23, 40 pls.). This third instalment of the great work which has been taken in hand by Harring and Myers falls in no degree behind its predecessors. These dealt with a revision of the family of the Notommatid Rotifers exclusive of the section with forcipate jaws, the subfamily Dicranophorinæ. It had been intended in the present issue to have dealt with this most interesting and important group, but the discovery of numerous new forms has shown that more field work is needed before a satisfactory revision of the Dicranophorinæ can be undertaken. In its place it has been practicable to put forward a revision of the genera Lecane and Monostyla. In all no less than 74 species of the former and 35 species of the latter genus are described, the descriptions, according to the more recent practice in the case of loricated Rotifers, being based solely upon the form of the lorica and foot when the animal is fully retracted. In this position each species is figured both in dorsal and in ventral view. Of the total of

109 species, 49 are now described for the first time. Lists are given of a number of species which the authors have not seen and as to whose validity they therefore express no opinion. Some remarks upon the classification of the Rotatoria introduce a new arrangement of the genera of the order Ploïma, which is divided into six major groups, viz. Notommatoidea, Asplanchnoidea, Brachionoidea, Filinioidea, Testudinelloidea and Trochosphaeroidea. The reasons for the placement of the families and genera are deferred for subsequent papers. D. B.

Regeneration in Stephanoceros Eichhorni.—L. v. UBISCH ("Beobachtungen über Bau, Funktion, Entwickelung und Regeneration der Reuse des Weibchens von Stephanoceros Eichhorni," *Zs. wiss. Zool.*, 1926, **127**, 590–607, 29 text-figs.). Here are described the structure, function and growth of the five ciliated arms which form the corona of the female Stephanoceros Eichhorni, and which combine to make a living trap for the capture of the lesser organisms on which this rotifer preys. v. Ubisch confirms the statement of de Beauchamp that the arms arise from a basal cingulum built up of thirteen cells, some of which have a single nucleus, some have two and one has five, each cell having its proper position and share in the development of the arms, which themselves have no nuclei and no cuticle. The cell number is constant, alike in the male, in the larval female which has not yet settled down and in the adult female. The arms arise as buds from the cingulum but grow rapidly. At first their ciliation is uniformly distributed; later the most of the cilia become arranged in short oblique rows. A series of experiments were made to ascertain whether the arms could be regrown if lost from injury, and with successful results. One or more arms could be partially or almost entirely cut away, and if food was plentiful, would be regrown in a very few days. With weakly or badly nourished individuals the arms were not replaced. In young animals the regeneration was quicker than in old. D. B.

Protozoa.

The Mitochondria of a Protozoan.—E. S. HORNING ("The Mitochondria of a Protozoan (Opalina) and their Behaviour during the Life Cycle," *Austr. J. Exp. Biol. Med. Sci.*, 1925, **2**, 167–71, 2 pls.). According to the author mitochondria are present in large numbers in Australian Opalinas which may be easily obtained from the rectal contents of starved frogs (*Hyla aurea*). They stain with iron hæmatoxylin after chrome-osmium fixation but only very faintly after fixation in Bouin's fluid. In the asexual multiplicative phase of the life cycle they are bent filamentous bodies and multiply by longitudinal fission. Immediately preceding encystment they may divide transversely and thus produce spherical bodies which persist in the cyst and the gametes. In the zygote they fuse into larger masses which later break up into small granules. These elongate and give rise again to the filaments or rods of the asexual forms. Evidence is brought forward showing that the synthesis of vegetative granules (storage products) may take place at the surface of the mitochondria. S. D. K.

Reduction of Vital Stains by Protozoa.—E. R. BECKER ("Vital Staining and Reduction of Vital Stains by Protozoa," *Biol. Bull.*, 1926, **50**, 235–8). Opalina has the power of reducing the vital dyes Janus green, brilliant cresyl blue, Nile blue, toluidine blue and methylene blue. *Paramœcium* shows similar reduction properties. This shows the presence of a reducase in the protoplasm of protozoa. The wood-ingesting protozoa of the termite's intestine possess a reducase in the food vacuoles as proved by the reduction of Janus green in these parts of the cell. The presence of this reducase is not an adaptation to the parasitic mode of life in the intestine where the oxygen pressure is low, since free-living protozoa also possess it. R. J. L.

Haplosporidium chitonis.—S. D. KING ("Cytological Observations on *Haplosporidium* (*Minchinia*) *chitonis*," *Q. J. Microsc. Sci.*, 1926, **70**, 147–57, 2 pls.). The Golgi bodies are concentrated in the form of a juxtanuclear mass in uninuclear individuals formed by the breaking up of the plasmodium, as well as in the sporoblast, young spore and, probably, in the plasmodium stages. In the mature spore the Golgi bodies become scattered and presumably give rise to fatty reserve material. The cytoplasmic sphere found in the sporoblast and young spore is that portion of the cytoplasm surrounded by the Golgi bodies. Nothing similar is found in the other stages of the life-cycle. The details of the life-history are not yet clear. No sexual process has been recognized and the question of the origin of the sporoblasts is still vague. C. D. F.

Holomastigotoides.—D. L. MACKINNON ("Observations on Trichonymphids: I. The Nucleus and Axostyle of *Holomastigotoides hemigymnum* Grassi (?)," *Quart. J. Microsc. Sci.*, 1926, **70**, 173–91, 2 pls., 2 text-figs.). The trichonymphid flagellate *Holomastigotoides* Grassi is provided with a hollow, fibrous axostyle in the upper expanded end of which the nucleus is lodged. This axostyle disappears during nuclear division and nothing is known of its mode of formation in the daughter flagellates. When the flagellate is about to divide, a spireme is formed from scattered granules and strands of chromatin. The spireme splits throughout its length. In *H. hemigymnum* Grassi it breaks up into four chromosomes, each of which preserves the longitudinal split. (In *H. mirabile* Grassi eight chromosomes are formed, in *H. hartmanni* Koidzumi only two; the exact number in *H. hertwigi* Hartmann is uncertain.) In *H. hemigymnum* no paradesmose is formed and no centrosomes appear. As the nucleus elongates the four split chromosomes open out into V-shaped bodies, which straighten, lie parallel to one another in the nucleus and then break in two in the middle of their length. Chromosome division, while apparently transverse, is here really longitudinal. As they move towards the poles, the half-chromosomes seem to stick together in pairs and the daughter flagellates each get two-paired chromosomes. These elongate and form interweaving coils, from which the reticulum of the resting nucleus is derived. C. D. F.

Opalina Ranarum.—S. D. King and J. B. Gatenby ("Note on Certain New Bodies in *Opalina ranarum* presumed to represent the Golgi Elements," *Quart. J. Microsc. Sci.*, 1926, **70**, 217–19, 1 pl.). The whole rectum (of frogs) containing the Opalina was fixed for 24 hours in Champy's fluid, then washed under the tap for 24 hours. It was cut into pieces which were kept in 2 p.c. OsO_4 for four days at 30°–60° C. After washing in distilled water the pieces were embedded in the usual way. In sections of whole Opalinas, the authors observed that the cilia of the latter could be traced down into the endoplasm where they joined the smaller end of pyriform osmiophile bodies. The authors assumed these to be Golgi elements. C. D. F.

Microsporidian parasites of Mysis.—L. Mercier and R. Poisson ("Microsporidies parasites de Mysis (Crust. Schizopodes)," *C. R. Acad. Sci.*, 1926, **182**, 1576–8). Whitish examples of *Mysis spiritus* were found to contain stages of a Nosema, N. *α*, in which the spores are pyriform with one polar capsule, and measure 3·5–4 by 2μ. *Neomysis vulgaris*, from brackish water, can be artificially infected with this parasite. Spores of another *Nosema*, N. *β*, are sometimes found in this *Neomysis*. They are cylindrical, slightly curved and rounded, measuring 2·5–3 by 9μ Similar spores are unknown in other Crustacea, and it is suggested that N. *β* is not normally parasitic on *Neomysis*, but on some other aquatic animal. S. D. K.

Leptomonas sp.—V. Nitzulescu ("Sur le Leptomonas sp., parasite de l'intestin de *Notonecta glauca* L., en Roumanie," *C. R. Soc. Biol.*, 1926, **95**, 124–5). *Leptomonas sp.*, a rare parasite of *N. glauca* near Bukharest, is typically narrow and drawn out posteriorly, pointed or truncated anteriorly, 10–18μ long, with an anterior free flagellum 12–17μ long. The nucleus is anterior, and the blepharoplast near it, or anterior to it. Small broad forms also occur, with shorter flagella, leading up to ovoid forms in which the flagellum is an intracellular rudiment. These are often found in rosettes. S. D. K.

BOTANY.

(*Under the direction of* DR. A. B. RENDLE.)

GENERAL,

Including the Anatomy and Physiology of Seed Plants.

Cytology,

Including Cell-Contents.

Chemical Nature of Cell-Membrane.—F. M. WOOD ("Further Investigation of the Chemical Nature of the Cell-Membrane," *Ann. Bot.*, 1926, **40**, 547–70, 3 figs.). An account of further investigations as to the occurrence of protein in the cell-wall. The special feature of this paper is a description of a new type of apparatus devised by the author for the purpose of chlorinating the sections. The method used for the detection of protein depends upon the liberation of iodine from potassium iodide after treatment with chlorine gas and sodium hydrogen phosphate solution. Leaves, petioles, aerial and underground stems, and roots of various plants were used. Lignified tissues gave various results, the colours being either yellow, brown or pink; this appears to indicate variations in the composition of the lignified cell-wall. Quantitative experiments show that not more than 0·001 p.c. of protein occurs in the cellulose cell-wall of any of the plants examined, and probably the amount is even lower than this. The amount of protein, if any, present in the cell-wall is not likely to interfere with cellulose and pectin reactions. S. G.

Nature and Cause of Secondary Sexual State.—J. H. SCHAFFNER ("Nature and Cause of Secondary Sexual States, with special reference to *Typha*," *Bull. Torr. Bot. Club*, 1926, **53**, 189–208). An account of the author's observations as to the position and development of the male and female organs in species of *Typha*, together with a review of evidence from the works of other writers upon the sexual organs of other plants. The persistency of the sexual state appears to be of the same nature and due to the same causes as vegetative differentiation; it is not due to difference in hereditary constitution but to functional states and physiological gradients which are responsible for a peculiar mode of control or reaction of the hereditary factors present. During evolution the cell has acquired potentialities which can be influenced by the presence of one or other of the sexual states, but fundamentally sexuality is a reversible physiological condition of the protoplasm. There are no sex-chromosomes and no sex-factors; sexuality is a potentiality of all cells and all organisms, and this potentiality probably has its basis in some structural condition of the protoplasm. Any cell or individual not differentiated beyond the possibility of regeneration or rejuvenation has sexual potentiality. Allosomes are impotent to produce sexual changes, but they appear to contain functional factors capable of setting up a proper physiological environment which throws the sex one way or the other. The cause of the sexual state is to be sought in the physiological activity of the cell. S. G.

CRYPTOGAMS.

Pteridophyta.

Fossil Plants of Old Red Sandstone.—W. H. LANG ("Contributions to the Study of the Old Red Sandstone Flora of Scotland. I. On Plant-Remains from the Fish-Beds of Cromarty. II. On a Sporangium-bearing Branch-System from the Stromness Beds," *Trans. R. Soc. Edin.*, 1926, **54**, 253–79, 4 pls.). An account of plant remains from Cromarty of unsettled affinity, including spores and sporangia found free in the rock; *Thursophyton Milleri* Salter; stems referred to *Hostimella*, two new species of which are described. The discussion of the affinities of the plants is postponed. A description of a sporangiferous branch-system from Stromness is also given. A. G.

Coal Flora.—FREDDA DORIS REED ("Flora of an Illinois Coal Ball," *Bot. Gaz.*, 1926, **81**, 460–8, 1 pl. and 1 fig.). A coal ball is a fossilized mass of vegetable remains in the coal measures, and contains, not mere impressions, but petrified plant tissue capable of yielding sections for microscopical examination. In the coal ball investigated by the author were found portions of plants that have hitherto been known as impressions only, in the American coal measures. Transverse sections of the steles of *Calamites*, *Sphenophyllum*, *Bothrodendron* and *Lyginopteris* were obtained. *Bothrodendron* yielded also transverse sections of a stem-tip, a megasporangium and microsporangium both attached to sporophylls and containing spores, and isolated megaspores. The microspores were in the tetrad stage; and in the megasporangium four megaspores were observed. The similarity between *Bothrodendron* and *Selaginella* is striking. A. G.

Neuropteris.—EDITH BOLTON ("A Critical Study of certain Species of the Genus *Neuropteris* Brongn.," *J. Linn. Soc. Bot.*, 1926, **47**, 295–327, 2 pls. and 5 figs.). An investigation of the fossil fern *Neuropteris* in the British coalfields, a discussion of the diagnostic characters, and a classification of the material into three species-groups —*N. flexuosa*, *N. obliqua*, *N. auriculata*—around which the many intermediates can be grouped. A. G.

Fossil Osmundaceæ.—M. D. ZALESSKY ("Sur les nouvelles espèces des Osmundaceæ permiennes," *Bul. Jard. Bot. Républ. Russe, Leningrad*, 1925, **24**, 73–87). The author describes the structure of the stele in

Bathypteris rhomboidalis from the Permian of the Ural mountains, comparing it with that of *Zalesskya* and *Thamnopteris*. He then describes the structure of the stipes and of the stem of two new species of *Thamnopteris* from the same Permian. And finally he gives a description of a new species of *Zalesskya*. A. G.

Vascular System of Selaginella.—Claude W. Wardlaw ("Size in Relation to Internal Morphology. No. 2. The Vascular System of Selaginella," *Trans. R. Soc. Edin.*, **54**, 281–308, 17 figs.). The author's aim has been to determine by actual measurement to what extent size may have acted as a causal factor in determining the structure and arrangement of the vascular system of *Selaginella*. The chapters of the paper are as follows:—General remarks on stelar structure in *Selaginella*. Analysis of the vascular system in different species (*S. Martensii*, *Willdenowii*, *Braunii*, *uncinata*). Factors in the stelar morphology of *Selaginella* (1. Distribution of tracheides in thin ribbons in relation to physiological needs. 2. Width of stelar band in relation to diameter of stem). Measurements (with table showing ratios of stele to stem in eighteen species; in polystelic species the thicker a stem becomes the greater the number of its stelar ribbons). *S. lævigata* var. *Lyallii* (has solenostele in rhizome, but in erect stem has anything up to sixteen scattered steles). The stelar lacuna. Changes in the apical meristem. Size a factor in stelar morphology. Discussion of causal and systematic views. A. G.

Lycopodium pungens.—M. M. Iljin ("On the *Lycopodium pungens* La Pylaie," *Bul. Jard. Bot. Républ. Russe, Petrograd*, 1923, **22**, 142–5). A note on *Lycopodium pungens* of La Pylaie, which the writer regards as a valid circumpolar species vicarious in the tundra to *L. annotinum*, just as *L. alpinum* is vicarious to *L. complanatum*. He gives a diagnosis of the species, with its synonymy and distribution, and sets out in parallel columns the distinctive characters of *L. pungens* and *L. annotinum*. A. G.

Abnormalities in Botrychium.—M. A. Chrysler ("Abnormalities in Botrychium and certain other Ferns," *Bull. Torrey Bot. Club*, 1926, **53**, 279–88, 1 pl. and 5 figs.). The various forms of abnormality to be met with in *Botrychium* and other ferns may be classed as follows:—1. Branching or duplication of the fertile spike, as a result of (*a*) splitting or chorisis; (*b*) wide separation of an ordinary branch; (*c*) reversion. 2. Occurrence of sporangia on pinnæ ordinarily sterile. 3. More or less complete sterilization of the fertile spike. These variations are discussed in turn. A. G.

New Ferns from the East.—Edwin Bingham Copeland ("Filices aliquot novae orientales," *Philippine J. Sci.*, 1926, **30**, 325–38, 1 pl.). Descriptions of new species of ferns from New Guinea (5), Philippine Islands (5), New Britain (1), China (1), together with two additions to the fern flora of New Guinea. *Tectaridium* is a new genus, a descendant from *Tectaria*; it contains two species, both from the Philippines and new to science. A. G.

Bryophyta.

Antherozoids of Anacrogynæ.—Amos M. Showalter ("Studies in the Cytology of the Anacrogynæ. I. Antherozoids," *Ann. Bot.*, 1926, **40**, 691–707, 1 pl. and 3 figs.). An investigation of antherozoids in some of the thalloid hepaticæ. In the case of *Riccardia pinguis* three varieties or races, from different European sources, were cultivated and revealed differences, apparently of genetic significance; they are described. The antherozoids of *Riccardia* and *Pellia*, when discharged from the antheridia, are enclosed each in a gelatinous envelope. A description is given of the movement of the antherozoid in freeing itself from this envelope. The antherozoid of one of the races of *R. pinguis* is shorter than those of the other two races. In *Riccardia*, *Pellia*, and *Fossombronia* each antherozoid bears at different points of its body two cilia of unequal length. A dark staining body is found at the base of each cilium. Measurements of the antherozoids are given. *Pellia Neesiana* appears to have the largest antherozoids yet recorded for the Bryophytes. The antherozoids of *Sphærocarpus*, when discharged, are embedded in a gelatinous matrix, but without an envelope. In *Conocephalum* neither gelatinous envelope nor matrix is found. A. G.

Reboulia.—Mary Constance Blair ("Sporogenesis in Reboulia hemisphaerica," *Bot. Gaz.*, 1926, **81**, 377–400, 2 pls. and 3 figs.). The writer gives a résumé of previous publications on sporogenesis in hepatics, and a detailed account of her own investigations of *Reboulia*—the mother-cell, the phases observed in the nucleus during division, the nucleolus, spireme, the 16 bivalent chromosomes, the cell plates, the spindle fibres, the spore coats—illustrated by camera lucida drawings with a magnification of over 900 diameters. A. G.

Portuguese Hepaticæ.—António Luis Machado Guimarães ("Sinopse das Briófitas de Portugal. Primeira Parte: Hepáticas," *Coimbra, Bol. Soc. Brot.*, 1925, Sér. 2, **3**, 5–87). A synopsis of the Portuguese Hepaticæ, 120 species, with keys to the families, genera and species, short diagnoses, critical notes, synonyms and distribution. A. G.

Cynodontium.—A. Cornet ("Les Cynodontium B.S. de Spa," *Bul. Soc. roy. Bot. Belg.*, 1926, **58**, 101–2). A discussion of some specimens of *Cynodontium* collected by Durieux last year in the immediate environs of Spa. Two of them are fertile, and obviously are *C. strumiferum*, a species not previously recorded for Belgium, though found long ago by Mlle. Libert in the adjacent province of Malmédy, now added to Belgium. The eight remaining species being sterile cannot be referred with certainty to *C. strumiferum* nor to *C. polycarpum*. The appearance of *Cynodontium* at Spa is subsequent to the careful bryological explorations made at Spa by Piré and Cardot some years ago. A. G.

New Belgian Mosses.—H. Van den Broeck ("Muscinées nouvelles pour la Flore Belge et Habitations nouvelles," *Bul. Soc. roy. Bot. Belg.*, 1926, **58**, 226–9). A list of fourteen bryophytes, six of which are additions to the Belgian flora, while others are new records for particular provinces. The most interesting is *Sphagnum hakkodense* Warnst. & Card., a Japanese species. A. G.

Mosses of a Jura Boulder.—CH. MEYLAN ("La flore bryologique et lichénologique du bloc erratique de La Grange-de-la-Côte," *Bul. Soc. Vaud. Sci. Nat.*, 1926, **56**, 165–72, 2 figs.) An account of the moss and lichen flora on a large gneiss boulder which is perched on a Portland limestone rock in the neighbourhood of St. Croix, a resort in the Swiss Jura. Both the boulder and its support are exposed to full sunshine; and the author has made a careful investigation of the species growing on each face of the boulder and its supporting calcareous rock. Three mosses and a hepatic were found on the siliceous boulder and nine mosses on its calcareous support; and each of these species was strictly confined to one or other of the two kinds of rock. Yet, theoretically, four of the calcicolous species might have occurred on the siliceous boulder, since they are sometimes found on such a substratum. But the four silicicolous species recorded for the boulder are never found on a calcareous substratum. A. G.

Mosses of East Baltic. — N. MALTA and J. STRAUTMANIS ("Übersicht der Moosflora des Ostbaltischen Gebietes. I.," *Acta Hort. Bot. Univ. Latviensis*, 1926, **1**, 115–42). An examination of the hepaticæ of the East Baltic district, about 110 species, with introductory remarks on the geographical affinities of the flora. The distribution of the species is recorded, and a bibliography is appended. A. G.

Mosses of Ussury.—LYDIA SAVICZ ("Enumeratio Muscorum Austro-Ussuriensium," *Acta Hort. Petropolitani, Petrograd*, 1923, **39**, 129–60). A critical enumeration of the mosses collected in Southern Ussury, in the Far East, by Komarow and Bulawkina, in 1913. The list contains 65 mosses, 3 sphagna and 5 hepatics. Among the interesting species are *Aulacomnium heterostichum*, *Georgia trachypoda*, *Haplohymenium triste*. Two species new to science were discovered, *Haplohymenium flagelliforme* and *Thuidium Komarowii*. In 1861 Regeland Maack recorded another novelty for the same region, namely, *Mnium ussuriense*, no specimen of which could the present author obtain for examination. A. G.

Mexican Mosses.—I. THÉRIOT ("Mexican Mosses collected by Brother Arsène Brouard," *Smithsonian Misc. Collect., Washington*, 1926, **78**, No. 2, 1–29, 14 figs.). An account of the mosses collected in the Mexican States, Michoacán and Puebla, by Frère Arsène previous to 1914 and now preserved in the Washington National Museum. About seventy mosses are listed, twelve of which are new to science. Critical notes are appended. A. G.

Moss Associations.—V. P. SAVICZ ("Note sur les associations des lichens et des mousses aux environs de la ville Augustow du gouvernement Suwalki, Pologne," *Bul. Jard. Bot. Républ. Russe, Petrograd*, 1923, **22**, 135–41). An account of some associations of lichens and mosses in the pine forests of Poland—on the bark of trees, on the ground, and on tree trunks. The author collected 65 lichens and 20 mosses near Augustow during the summer of 1914. A. G.

Thallophyta.

Algæ.

Plankton Algæ of Iowa.—Gilbert Morgan Smith ("The Plankton Algæ of the Okoboji Region," *Trans. Amer. Microsc. Soc.*, 1926, **45**, 156–233, 20 pls. and 1 fig.). A critical account of about 200 forms collected in the lakes and ponds of N.W. Iowa, with tables of the local distribution of the forms. A key to the genera is provided, and more than 400 figures appear in the plates; and 83 Myxophyceæ and 167 Chlorophyceæ are recorded. The novelties are 11 species, 9 varieties, 2 forms. A. G.

Water-bloom in Italy.—Rina Monti ("La 'Fioritura' delle acque sul Lario," *Milano, Rend. Reale Ist. lomb.*, 1925, ser. II., **58**, 763–72, 1 pl.). An account of the water-bloom observed on the surface of Lago di Como in August 1925. This phenomenon is very rare on the large sub-alpine lakes of Italy. It lasted for some days during a spell of calm weather, and rendered the water intensely green and turbid, the temperature of the water being about 18° C. Microscopic examination showed the phenomenon to be due to a vast development of the plankton alga, *Microcystis aeruginosa*, a blue-green alga of the group Chroococcaceæ. The causes which contribute to the phenomenon are discussed. A. G.

Sporulation of Anabæna.—Olga Troitsky ("Some Biometrical Observations on the Sporulation of Anabæna Scheremetievi Elenk., and its New Variety—var. macrosporoides," *Bul. Jard. Bot. Républ. Russe, Petrograd*, 1922, **21**, 168–81). In the summer of 1921 *Anabæna Scheremetievi* and its new var. *macrosporoides* were abundant as plankton in two ponds at Tsarskoje Selo, the variety appearing two or three weeks later than the typical form. The variety differs from the type in the size and shape of the resting spores. The spores were investigated biometrically. In each filament one vegetative cell and one heterocyst were measured. In the case of the spores the ratio of length to breadth was calculated, being 1·2 in the typical form, and 1·65 in the variety. The heterocysts of the variety were found to be 1–2 μ less than in the type. The new variety approaches *A. macrospora* Kleb., linking it to *A. Scheremetievi*. The fertile filaments of the variety are thinner than the vegetative. In spore-development a vegetative cell enlarges, becomes elliptical, and the exospore is formed like a frame round the spore; the intervening space then becomes filled in. The pseudovacuoles disappear. The mature spore has a double contour, no joints between the endospore and neighbouring vegetative cells, no pseudovacuoles, a lighter colour. A. G.

Hydrochrome of Algæ.—A. N. Danilov ("Hydrochrome der Cyanophyceen und Florideen," *Bul. Jard. Bot. Républ. Russe, Petro-*

grad, 1922, **21**, 114–43). A spectroscopical and chemical investigation of the soluble colouring matter of certain blue-green and red algæ from the Arctic Ocean. A. G.

Melosira.—O. V. TROITZKAJA ("Über die Auxosporenbildung bei Melosira varians Ag.," *Bul. Jard. Bot. Républ. Russe, Leningrad*, 1925, **24**, 46–60, 3 tables). After a statistical investigation of the measurements of the sterile and fertile cells of *Melosira varians* Ag., the author concludes that the sterile, as also the auxospore, cells are of equal length; but that the breadth varies between 8·5 and 50 μ. Auxospore formation takes place in cells 8·5 to 17 μ long, the relation of length to breadth being greater than in sterile cells; and it occurs mostly in cells of less than average size, with a breadth of 12–14 μ; but the smallest cells are also capable of forming auxospores. Spore-forming cells have a smaller surface and circumference than sterile cells; and the ratio of the circumference to the whole surface is smaller than in sterile cells. In auxospore-formation the reduction of the cell-dimensions plays an important part, and further the process is dependent on certain external conditions. A. G.

Hungarian Diatoms.—B. v. CHOLNOKY ("Über die Diatomeen-Assoziationen der Umgebung des Dorfes Szamosfalva bei Kolozsvár," *Hedwigia*, 1926, **66**, 283–92, 1 fig.). An account of the associations of diatoms in the environs of Szamosfalva village near Kolozsvár, with a revision of the work of the older Hungarian diatomists, who had recorded several purely marine and brackish-water species from the salt waters of Szamosfalva and Torda, and had thereby awakened some doubts, especially in view of the number of fresh-water species found in these waters. An examination of new samples from eight sources has revealed two marine species in salt waters which, though chemically quite different from sea-water, have a sufficiently high osmotic pressure to suit these diatoms. The diatoms in the different samples are enumerated and discussed, and ten of them are figured. A. G.

Madras Volvocaceæ.—M. O. PARTHASARATHY IYENGAR ("Observations on the Volvocaceæ of Madras," *J. Indian Bot. Soc., Madras*, 1920, **1**, 330–36). Seven genera of Volvocaceæ have been collected in Madras, where they flourish best in rain pools formed during the summer monsoon. They prefer a moderate intensity of light, sinking in the middle of a brilliant day; they sink also at night. Some rain pools on the Madras beach are surrounded by a green zone of these algæ coating the wet sand. A. G.

Ulvaceæ.—NELLIE CARTER ("An Investigation into the Cytology and Biology of the Ulvaceæ," *Ann. Bot.*, 1926, **40**, 665–89, 2 pls.). An account of some peculiarities observed during an attempt to settle the true affinity of the Ulvaceæ. In *Monostroma* the cells of the stalk and holdfast are uninucleate, but in *Ulva* multinucleate. In *Ulva* (distromatic) the chloroplasts with the pyrenoids lie on the outer wall of the cells, and the nuclei on the inner wall; while in *Monostroma* (one-layered) the chloroplasts lie normally on one surface of the lamina, and the nuclei on the opposite side. In vegetative cell-division the pyrenoid does not disappear entirely during mitosis in Ulvaceæ. The pyreno-crystal may lose some of its staining properties, or may become broken up. In the former case, one of the daughter cells receives the pyrenoid, and the other daughter cell develops a pyrenoid *de novo*. In the other case, fragments serve as bases for the reorganization of a pyrenoid in each of the daughter cells. The nuclei are exceedingly small; their division is essentially mitotic; a segmented spireme is present; and the chromosomes are probably ten in number. The chromosomes tend to fuse in the metaphase and anaphase. The cleavage plane between the daughter cells in *Ulva* is undulating at first, then straightens out. Swarm spores, either sexual or non-sexual, are formed by successive nuclear divisions and cleavage of the protoplast, the protoplasts behaving essentially as in vegetative cell division. In *Monostroma latissimum* the plants are diœcious, gametes from plants of different sex being requisite for the production of zygotes. Gametes of both sexes may develop parthenogenetically in exactly the same way as zygotes. The spores increase vastly in size for about forty days, and form a large thick-walled resting cyst about 50 μ in diameter, which does not germinate for several months. The development of the new *Monostroma* plant from the cyst was not observed. A. G.

Botrydium in India.—M. O. PARTHASARATHY IYENGAR ("Note on Two New Species of Botrydium from India," *J. Indian Bot. Soc., Madras*, 1925, **4**, 199–201, 5 pls.). An account of two new species of *Botrydium*—*B. tuberosum* from Madras, and *B. divisum* from Calcutta. The significance of the branching of *B. divisum* is discussed in relation to *Protosiphon* and possibly *Dichotomosiphon*. Reference is made to the other species of *Botrydium* found in India. A. G.

Epiphyllous Algæ.—N. N. VORONICHIN ("Les Algues épiphylles en Transcaucasie," *Bul. Jard. Bot. Républ. Russe, Petrograd*, 1923, **22**, 71–6, 1 fig.). Five species of epiphyllous algæ were found in Transcaucasia:—(1) *Phycopeltis epiphyton* Mill. on leaves of *Abies Nordmanniana* and *Buxus sempervirens*; (2) *Trentepohlia abietina* (Flot.) on leaves of *A. Nordmanniana*; (3) *Pleurococcus vulgaris* (regarded by Chodat in 1913 as a reduced form of *Prasiola*) on leaves of *A. Nordmanniana* and *Picea orientalis*; (4) *Scytonema intermedium* de Wild.; and (5) *Nostoc* in a young state, both on *Abies Nordmanniana*. Fritsch's indication (1907) that a peculiarity of the torrid zone is the luxuriant development of aerial algæ suggests a tropical trace in the vegetation of Transcaucasia. A. G.

Reproduction in Spirogyra.—FRANCIS E. LLOYD ("Maturation and Conjugation in Spirogyra longata," *Trans. Roy. Canadian Inst.*, 1926, **15**, 150–98, 4 pls. and 2 figs.). An account of the details of lateral conjugation in *Spirogyra longata*, nuclear fusion and the ultimate fate of the chloroplast in the zygospore being excluded from consideration. Under the head of *Maturation* are discussed such points as: origin of gametes, formation of the "beak" (conjugation tube), the crescentic membrane, changes in the cell, attachment of male gamete and its contraction, perforation of the crescentic membrane. Under the heading

of *Gametic Union* are described three phases: (1) from contraction of male to fusion of gametes; (2) reduction of volume of male gamete; (3) passage of chloroplast and ectoplasm. Then the zygotic contraction is described, and finally the pathology of conjugation is discussed.
A. G.

New Zygnemaceæ.—H. SKUJA ("Zwei neue Zygnemaceen mit blauem Mesospor," *Acta Hort. Bot. Univ. Latviensis*, 1926, **1**, 109–14, 1 pl.). The colour of the ripe zygotes of Zygnemaceæ is due to the coloured mesospore or middle layer of the cell membrane. This is usually yellow to reddish brown, rarely olive; only in *Zygnema* itself has a blue mesospore been found hitherto. But last year two new species with blue spores were discovered near Riga, one of them being a *Mougeotia*. Descriptions and figures are given. Six species of *Zygnema* with blue spores are now known. A. G.

Zygnemaceæ.—M. O. PARTHASARATHY IYENGAR ("Note on some Attached Forms of Zygnemaceæ," *J. Indian Bot. Soc., Madras*, 1923, **3**, 192–200, 4 pls.). Three Zygnemaceæ were studied with regard to their methods of attachment. In *Spirogyra* the hapteron was well developed and of a lobed disc-shape, at the base of the filament, or arising laterally in contact with the substratum. In *Zynema* the haptera are knob-like and lateral. In *Mougeotia* the end of the filament coils spirally round another filament, and sometimes lateral knobs occur.
A. G.

Hydrodictyon indicum. — M. O. PARTHASARATHY IYENGAR ("Hydrodictyon indicum, a new species from Madras," *J. Indian Bot. Soc., Madras*, 1925, **4**, 315–7, 2 pls.). To the well-known *Hydrodictyon reticulatum* was added in 1913 a second species, *H. africanum*, from South Africa. A third species has now been found in Madras. Its structure is described and figured. A. G.

Oedogoniaceæ of Iowa.—L. H. TIFFANY ("The Filamentous Algæ of North-western Iowa, with special reference to the Oedogoniaceæ," *Trans. Amer. Microsc. Soc.*, 1926, **45**, 69–132, 16 pls.). An account of the filamentous algæ collected near Milford, in the Okoboji region of N. W. Iowa, mostly during the late spring, summer and early autumn. The total number of forms recorded is 200; namely, 35 Myxophyceæ and 165 Chlorophyceæ. The Oedogoniaceæ are particularly well represented by 75 species, varieties and forms; and keys to *Oedogonium* and *Bulbochæte* are supplied, as well as ten plates. One new species, *Oedogonium Wylii*, is described; and several forms are new records for North America. A. G.

Nuclear Division in Characeæ.—JOHN S. KARLING ("Nuclear and Cell-Division in Nitella and Chara," *Bull. Torrey Bot. Club*, 1926, **53**, 319–79, 9 pls. and 6 figs.). The author gives a résumé of previous work on the general cytology of Characeæ, and indicates many differences of observation and interpretation. He then details his own investigations of *Chara coronata*, *Nitella gracilis*, and two other species. After describing the methods employed with fixed material, he gives a detailed account of the resting nucleus, the prophase, metaphase, anaphase and telophase, the cell-plate and wall-formation, the centrosomes, the chromatic granules in the cytoplasm. He describes also the nuclear and cytoplasmic changes of plants cultivated in water and sugar solutions, and the nuclear and cell division in aceto-carmine preparations. He intends to continue these preliminary investigations. The antheridial filaments are specially good material for study. A. G.

Choreocolax Polysiphoniæ Reinsch.—H. H. STURCH (*Ann. Bot.*, 1926, **40**, 585–605, 15 figs.). An account of this minute epiphytic Floridean alga. *Choreocolax* is holoparasitic on *Polysiphonia fastigiata*, which is itself hemiparasitic on *Ascophyllum nodosum*. The subtending cell of the procarp functions as the auxiliary mother-cell, and after the transference of the zygote nucleus the carposporophyte is developed from the auxiliary cell. All the stages of the development of the carposporophyte are described in detail, the mature cystocarp much resembling that of *Galaxaura*. As the three plants, *Choreocolax Polysiphoniæ*, *Harveyella mirabilis* and *Harveyella pachyderma*, differ wholly from each other in the development of the carposporophyte, the name *Holmsella pachyderma* is suggested in the place of the erroneous name *Harveyella pachyderma*. It is shown that these three parasitic genera cannot be included in the group Nemalioninæ of Schmitz, and, as their mature carposporophytes do not resemble those of any other Floridean group, it is suggested that they should remain for the present unattached as a small group of parasitic Florideæ. In the remote past these genera had a fully elaborated reproductive cycle of three generations. Like other small Florideæ they were forced to adopt an epiphytic mode of life to avoid extinction in the struggle for existence. The antheridia, procarps, and tetrasporangia invariably occur on separate plants. The investigation of *Choreocolax* was made on fresh material collected every fortnight throughout the year at Plymouth. A. G.

Welsh Algæ.—KENNETH REES ("Previous Investigations into the Distribution and Ecology of Marine Algæ in Wales," *J. Linn. Soc. Bot.*, 1926, **47**, 285–94). A chronological account of such literature published during the past four hundred years as contains references to algæ observed on the coasts of Wales, or of manuscripts preserved in libraries. The number of works cited is seventy-nine, and the literature is divided into six periods ;—I (1500–1650) : the Age of the herbalists. II (1650–1725) includes John Ray and Edward Lhwyd. III (1725–1760) : Dillenius, Brewer, and Green. IV (1760–1824) : Hudson, Lightfoot, Stackhouse, Evans, Aikin, Turner, Dillwyn, Young, Davies. V (1824–1878) : Ralfs, Salwey, Gutch, Morgan. VI (1878–1920) : several modern collectors. The records of all the investigators cited in the paper have been arranged in a manuscript list comprising over three hundred species. A. G.

Mediterranean Algæ.—V. SCHIFFNER ("Beiträge zur Kenntnis der Meeresalgen," *Hedwigia*, 1926, **66**, 293–320). Five short articles :—(1) Some algæ from Naples (9 species, with critical notes). (2) The algal flora of Tunis (52 species). (3) Algæ from Riccione, near Rimini (16 species). (4) Some algæ from the Adriatic (7 species), and Helgoland

(2 species). (5) Two species of *Ectocarpus* which are but little known—namely, *E. paradoxus* Kuckuck and *E. irregularis* Kütz. The novelties are 4 species and 2 varieties: and many species are critically discussed. A. G.

Algæ of the Canary Islands.—F. BØRGESEN ("Marine Algæ from the Canary Islands, especially from Teneriffe and Gran Canaria. I. Chlorophyceæ," *Kgl. Danske Vidensk. Selsk. Biolog. Meddel.*, 1925, **5**, No. 3, 1–123, 49 figs.). A critical account of the marine Chlorophyceæ collected by the author in the Canaries early in 1921. Previous work on the subject had been done by Montagne (1840), Piccone (1884 and 1886), Mlle. A. Vickers (1896), Sauvageau (1912). The present work includes a revision of all previous records, and gives a total of over seventy species, including three new species of *Cladophora*, and a new genus—*Pseudochlorodesmis*—founded on *Bryopsis furcellata* Zanard. A comparatively large proportion of the species are common to the Canaries and the West Indies. A. G.

Fungi.

Study of Leptomitaceæ.—DAVID H. LINDER ("A New Species of *Araiospora* from British Guiana," *Mycologia*, 1926, **18**, 172–8, 1 pl.). The author has discovered a new species, *Araiospora coronata*, growing on submerged fruits of hog-plum (*Spondias lutea*) and other submerged vegetation. Cultures enabled him to follow sporangial and spore formation, though the sexual stage of reproduction was not found. Full details are given of spore germination and further development, and reasons for considering *A. coronata* a new species. A. L. S.

Study of Synchytrium.—A. QUINTANILHA ("Contribuição ao Estudo dos Synchytrium, *Coimbra, Bol. Soc. Brot.*, 1925, Sér. 2, **3**, 88–195, 4 pls.). After the introduction, Quintanilha gives a general account of the genus and of a number of species and their various characteristics. He then passes in review the investigations of such workers as De Bary and Woronin, of Schröter, Dangeard, Harper, Lüdi and others. He notes a new conception of study by Lüdi in so far as he insisted on the necessity of experiment by cultures; special attention is given to Percival's work on *Synchytrium endobioticum*. A long account of work done by the author on *S. papillatum* follows the more general paper. The systematy of the genus is given, and all known species are arranged under two genera, *Synchytrium* and *Pycnochytrium*, and the affinities with other families. A long bibliography follows, and description of plates. A. L. S.

Onion Mildew.—PAUL A. MURPHY and ROBERT M'KAY ("The Downy Mildew of Onions (*Peronospora Schleideni*), with Particular Reference to the Hibernation of the Parasite," *Dublin Sci. Proc. R. Soc.*, 1926, **18**, 237–61, 4 pls.). The presence of a perennial mycelium had already been indicated by Murphy: the subject has now been thoroughly investigated. Onions were infected with mildew through the leaves, the mycelium spreading down to the bulbs. Resting-spores were occasionally found in the leaves; soil infection is practically non-existent. Most of the disease arises from perennial mycelium harboured in onions during the winter and producing an early outbreak of mildew in spring. As a remedy it has been proved that heating is effective. When onion-bulbs in air were heated to 40° C. for eight hours, the mycelium of the fungus was completely destroyed. A. L. S.

Downy Mildew of the Hop.—W. M. Ware ("*Pseudoperonospora Humuli* and its Mycelial Invasion of the Host Plant," *Trans. Brit. Mycol. Soc.*, 1926, **11**, 91–107, 4 text-figs.). Though only found in Europe for the first time in 1920, the fungus is now widespread throughout our country. W. M. Ware has made a study of the attack of the parasite, and its effect on the host plant. He has found that the mycelium of the fungus may persist during the winter in underground portions of the hop plant. Hyphæ were found to be present within the cortex and pith of the stems rising from the root stocks; they have been also found during the winter in the pith, phloem and cortex of nursery "sets," and in several cases in the cortex of the roots. Oospores of the fungus occur plentifully in the pith of terminal and lateral spikes, and within the bracts and bracteoles of the "cone." The literature bearing on this fungus is cited. A. L. S.

Study of Erysiphaceæ.—Et. Foex ("Notes sur quelques Erysiphacées," *Paris, Bul. soc. mycol.*, 1926, **41**, 417–38, 15 pls.). The writer has made a prolonged study by observations and by culture of species of *Sphærotheca*, *Podosphæra Oxyacantha*, *P. leucotricha*, *Phyllactinia corylea* and *Microsphæra Mougeotii*. He describes the attack and the persistence of the fungi on the various hosts, with various biological notes as to the duration of spores, and the development of the conidial stages. Special attention was given to the conidiophore of *Podosphæra Oxyacantha*, in which Foex found the fibrosine corpuscles of Zopp; he notes their form and occurrence, and decides that they have affinity with callose, and that very probably they function as reserve material. A. L. S.

Record of Rare Discomycete in Belgium.—H. Lonay ("Une nouvelle Station d'un Champignon peu connu en Belgique, Le *Sarcosphæra sepulta* Schroet.," *Bul. Soc. roy. Bot. Belgique*, 1926, **58**, 103–4, 3 figs.). Lonay found this rare species on the sand dunes. Usually it grows on calcareous soils. A. L. S.

Study of Pyronema confluens.—Wilfrid Robinson ("The Conditions of Growth and Development of *Pyronema confluens* Tul., *P. omphaloides* (Bull.) Fuckel," *Ann. Bot.*, 1926, **40**, 245–72, 4 text-figs.). The Ascomycete *Pyronema confluens* is interesting in the fact that it is restricted in habitat, usually to ground that has been burned. It is, however, an easy plant to grow on artificial cultures. Robinson has made a study of its development, and he has shown by experiment that vegetative and reproductive growth are controlled by external conditions, such as moisture, light, and the nature of the media used. All these conditions have been analysed and their influence followed in detail. It was found that in the dark lateral tufts of hyphæ were formed, and these contained large quantities of oil. The pink colora-

tion characteristic of the fungus is connected with reproductive activity: it does not develop in darkness, nor in the presence of carbon dioxide.
A. L. S.

Clamp Connections in Ascomycetes.—M. and MME. FERNAND MOREAU ("Crochets et Anses Ascogènes," *Paris, Bul. Soc. Mycol.*, 1926, **41**, 469–71, 1 text-fig.). The authors had described clamp connections in certain lichens on the formation of the ascus. They have repeated their observations in the Ascomycete *Pustularia vesiculosa*, and they have verified Dangeard's description of ascus formation in that species. They recognize that there are two methods of ascus formation, and they await the results of further work before asserting definitely the homology of the clamp connections of Basidiomycetes with the "crochets" in the Ascomycetes. A. L. S.

Study of Physalospora.—NEIL E. STEVENS ("Two Species of *Physalospora* on *Citrus* and other hosts," *Mycologia*, 1926, **18**, 206–17, 2 text-figs.). The fungus has been somewhat misunderstood and placed under other genera. It is peculiar in having coloured spores, and on that account has been named *Ph. fusca*. The pycnidial stages have been generally referred to *Diplodia* or *Sphaeropsis*. A. L. S.

Some Florida Fungi.—AMY G. WEEDON (*Tom. cit.*, 218–23, 1 pl., 2 text-figs). A number of species, most of them new, parasitic on leaves, etc., have been described. Two new genera are included, *Exophoma* and *Macrophomopsis*. A. L. S.

Study of Sclerotinia.—H. H. WHETZEL ("North American Species of *Sclerotinia*: I," *Tom. cit.*, 224–35, 8 pls., 1 text-fig.). The author gives here a study of *Sclerotinia* species on *Erythronium*; these are *S. gracilis* and *S. Erythronii* sp. n. The character and development of these two parasitic fungi are given, as well as their locality and history. A. L. S.

New and Noteworthy Fungi: IV.—JOHN DEARNESS (*Tom. cit.*, 236–55). This is a first instalment in a study of Discomycetes. Several species and varieties and one genus, *Phragmodothidea*, are new to science. A. L. S.

Heterothallism in the Genus Penicillium.—H. G. DERX (*Trans. Brit. Mycol. Soc.*, 1926, **11**, 108–12). The author describes his paper as a preliminary note on this important subject. He has had a number of species under observation in culture. One of these, *P. luteum*, afforded ascocarps at first in the succession of cultures; these gradually diminished, and the trial was made of single-spore cultures in which perithecial formation entirely disappeared. Two-spore cultures were then tested, and the abundance of perithecia formed left no doubt as to the heterothallic character of the fungus. There are many problems in connection with this discovery which remain to be solved. A. L. S.

Notes on Penicillium.—PH. BIOURGE ("Périthèces et Sclérotes chez les Penicillium," *Volume jubilaire, V. Grégoire, 2nde partie "La cellule,"* 1925, **36**, 447–56, 1 pl.). The above is a note on previous work by the author on the genus *Penicillium*, and he points out relations between several species. He indicates the difference between *Penicillium italicum* Uchmer and his own species, *P. Zukalii*, in that the latter produces coremia and sclerotia, while *P. italicum* never forms coremia, and, at least in monospermous cultures, does not produce sclerotia. Biourge has reproduced a drawing of a Petri dish of *P. Zukalii* with growths of these different stages. A. L. S.

Fungi Imperfecti.—F. Sternon ("Considérations sur la Systematique des Champignons Imparfaits (Deuteromycetes)," *Bull. Soc. roy. Bot. Belgique*, 1926, **58**, 230–6). Sternon describes the unsatisfactory condition of systematy in the Hyphomycetes, and quotes as an example of the difficulty of arrangement the genus *Ramularia*. He suggests as necessary a more intensive study of these fungi by culture methods. A. L. S.

Rusts of South America.—H. S. Jackson ("The Rusts of South America based on the Holway Collections: I.," *Mycologia*, 1926, **18**, 139–62, 1 pl.). The collections of Professor and Mrs. Holway amount to a very large number, some 2,049, most of them rusts. Jackson has undertaken an examination of these, and the present paper deals with 49 species. They are arranged according to hosts, beginning with Pteridophyta, on which he records three different rusts. On Cyperaceæ, the next family, he describes several new to science; those already recorded are accompanied by biological notes. The work so far has not gone beyond Orchidaceæ. A. L. S.

Black Rusts in Scotland.—I. Maxwell and G. B. Wallace (*Trans. Brit. Mycol. Soc.*, 1926, **11**, 138–45, 1 pl.). Black rust, *Puccinia graminis*, is one of the most widespread and most serious diseases of cereals. The writers indicate the localities where it has been reported in Scotland, and also the associated presence of the barberry, the alternate host. From observations and from inoculation cultures they find that the rust occurs in Scotland in scattered areas, but only in the immediate vicinity of affected barberries is the rust on cereals and grasses heavy. They find also that there is no evidence that the disease is carried over the winter by uredospores, and that therefore the destruction of barberries would eventually eliminate the disease. A. L. S.

Contribution to the Study of Ustilaginales. — R. Ciferri ("Seconda Contribuzione allo Studio degli Ustilaginales," *Ist. Bot. Univ. Pavia Lab. Critt. Ital.*, 1924, Ser. 3, **1**, 77–97). In this contribution Ciferri describes fully species of this order (Nos. 23–47), a continuation of work previously published. The present survey deals with the genera *Tuburcinia*, *Entyloma*, *Melanotænium* (one species), and a conidial stage of *Entyloma*, *Cylindrosporium Ranunculi*. The author has sought to clear up ambiguity and confusion in nomenclature and determination. His own descriptions are clear, and include notes and comparisons with other species. A. L. S.

Smut of Western Rye Grass.—W. P. Fraser and G. A. Scott (*Phytopathology*, 1926, **16**, 473–7, 2 text-figs.). The smut attacked

Agropyron tenerum in the prairie provinces of Canada. The grass is largely used for hay, and its economic value was seriously impaired. The smut has been assigned to the species *Ustilago bromivora*; it infected several other grasses of the genera *Agropyron* and *Bromus*. It was found that the disease was spread by spores clinging to the seeds, and that treatment of the seed by formaldehyde solution killed the spores.
A. L. S.

Smut of Sedge.—C. W. Edgerton and E. C. Tims (*Mycologia*, 1926, **18**, 169–71, 1 pl., 1 text-fig.). The smut *Testicularia Cyperi*, described by the authors, is of rare occurrence, but not uncommon in southern Louisiana in the ovules of the sedge *Rhynhospora corniculata*. The sorus consists of a hard false membrane enclosing spore balls separated from each other by a network of mycelial threads. The spores were germinated at maturity, but if kept too long (from August to February) they were evidently dried up and dead. A. L. S.

Fungicides for Covered Smuts.—E. B. Lambert, H. A. Robinson, and H. H. Flor ("The Effectiveness of various Fungicides in controlling the Covered Smuts of Small Grains," *Phytopathology*, 1926, **16**, 393–411). A long series of experiments with fungicides is given and tabulated. Formaldehyde spray treatment and copper carbonate dust were used and the results contrasted. The latter was the most effective in dealing with bunt of wheat and smuts of oats. Formaldehyde spray controlled the smuts of hulled oats more completely than any other fungicide. A. L. S.

Culture Studies of Psilocybe coprophila.—Kathryn A. Gilmore (*Bot. Gaz.*, 1926, **81**, 419–32, 2 pls.). The author gives a full description of the fungus and of her methods of culture. The question of heterothallism was gone into most thoroughly: monosporous cultures were made and kept growing for a considerable period, but no clamp connections were formed, and in the end the cultures died off. One of these first 24 cultures did produce clamps, but it was thought that it might have been a polysporous culture. Crossings between some of the primary cultures resulted in a secondary mycelium in which clamp connections were formed, and finally basidiocarps. Oidia were produced on both primary and secondary mycelium: those from the primary mycelium germinated to form haploid mycelia; those from the secondary mycelium sometimes formed diploid mycelia. A. L. S.

New Fungi.—A. Beauseigneur ("Champignons observés dans les Landes," *Paris, Bul. Soc. Mycol.*, 1926, **41**, 468–7, 2 pls.). Two new species are described, *Amanita Gilberti* from the sands of pine woods, and *Lepidella Beillei*, somewhat resembling *L. echinocephala*, but distinguished by the coloured gills (rose-yellow to clay-coloured). A. L. S.

Note on Pleurotus Eryngii.—L. Lutz ("Sur une prolifération des carpophores chez le *Pleurotus Eryngii* en culture pure," *Tom. cit.*, 468). The author describes a new type of proliferation. The fungus, somewhat starved in the culture, forms—after a period of rest—new small carpophores on the stalk. Lutz points out that the fungus in pure cultures is immune from causes of decay, such as larvæ and microbes, and therefore persists long enough to form the new developments. A. L. S.

Study of Coprinus.—RENÉ VANDENDRIES ("La Tetrapolarité sexuelle des Coprins," *Bul. Soc. roy. Bot. Belgique*, 1926, 58, 180–6). The species examined was *Coprinus micaceus*, and as a result of cultural research it was found to be heterothallic, tetrapolar and with clamp connections. No carpophores were formed in cultures of purely diploid spores, but clamp connections were formed. In the haploid cultures there appeared only sterile hyphæ without clamps. A. L. S.

Monograph of Russula.—ROLF SINGER ("Monographie der Gattung *Russula*," *Hedwigia*, 1926, 66, 163–260, 1 pl.). Singer realizes the difficulty of determination of species in this genus. He indicates the different characters and sketches the arrangement into sections that has been proposed by mycologists. He himself has found the most reliable characters in the flesh of the pileus, by which he is able to arrange all species in four sections:—*Constantes*, *Decolorantes*, *Rigidæ* and *Compactæ*. Each of these sections is divided into several subsections. He deals with 73 species of *Russula* and gives a full account of each. A considerable bibliography is appended. A. L. S.

Cyphella Species.—ALBERT PILAT ("Zwei neue Arten der Gattung *Cyphella* Fr. aus der Tschechoslowakei," *Tom. cit.*, 261–4, 1 text-fig.). The author has determined 42 species and 6 varieties of Cyphellaceæ from Czecho-Slovakia. The new species are fully described. A. L. S.

Study of Armillaria mellea.—S. M. ZELLER ("Observations on Infections of Apple and Prune Roots by *Armillaria mellea*," *Phytopathology*, 1926, 16, 479–84, 3 text-figs.) This fungus gives rise to widespread orchard disease of roots in the North-West of America. The writer has made a study of the infection of fruit trees by the fungus. He has proved that infection may come in three ways: (*a*) through wounds, a well-known method of penetration by the fungus hyphæ; (*b*) at points of contact of diseased and healthy roots of different kinds of trees; (*c*) entrance may be gained at the point of emergence of lateral roots through the rupture of the bark cortex as the young root pushes its way out. When infection takes place on contact of diseased with healthy roots it is probable that the healthy bark may be acted on by a toxic substance given off by tissues decayed by the fungus.

A. L. S.

British Mycology.—E. M. WAKEFIELD ("The Tintern Foray," *Trans. Brit. Mycol. Soc.*, 1926, 11, 3–9). An account is given of the Foray which was held in the spring, and consequently a number of species were collected which occur only in the earlier months of the year; a large number of Uredineæ, Pyrenomycetes, Discomycetes, etc., were found and determined by the members. A. L. S.

The Dublin Foray.—E. M. WAKEFIELD (*Tom. cit.*, 11–18). This being the Autumn Foray the ground covered and the species collected far exceed the record of Tintern. Several districts in the neighbourhood of Dublin were explored, and a very large number of species belonging to the different families of fungi were collected, and have been placed on record by Wakefield and others. A large number are marked as new to Ireland; two microscopic species are new to the British Flora. A. L. S.

Some Tropical Fungi.—T. PETCH ("Matula," *Trans. Brit. Mycol. Soc.*, 1926, **11**, 67–81, 2 pls., 2 text-figs.) A conidia-bearing fungus from Cuba was published by Berkeley as ***Michenera artocreas***. At a later date Berkeley and Broome named a fungus from Ceylon as *Artocreas poroniaeforme*, adding later another species from the United States, *Artocreas Michenera*. After a while the authors recognized the comparison of names and dropped the generic name *Artocreas* in favour of *Michenera*. The fungus from Ceylon, *Artocreas poroniaeforme*, was made by Massee the type of a new genus of Gasteromycetes, ***Matula***. After cultural studies, fully described in the paper, Petch has proved that "*Artocreas poroniaeforme* (Ceylon) is a conidial form of *Peniophora Habgallae*; ... *Michenera artocreas* has been shown by Lyman to be a conidial form of *Corticeum subgiganteum*." The mode of formation of the conidia is the same in both genera, the conidium being formed in successions of spore mother-cells formed basipetally on the conidiophore; but *Michenera* and *Artocreas* differ in other respects, and both genera must be retained. A. L. S.

American Mycology.—L. O. OVERHOLTS ("Mycological Notes for 1925," *Mycologia*, 1926, **18**, 179–84, 1 pl., 1 text-fig.). The writer publishes a series of original notes on fungi that have come under his observation during the year. For some of them he gives slight variations in spore sizes, etc.; in others, as in *Gonatobotryum maculicola*, he describes and figures a luxuriant growth on leaves of *Hamamelis virginiana*. He also records the occurrence of *Melampsora Bigelowii* on stems of *Salix*, forming cankers, and in many cases killing the stems. A witches'-broom was noted on *Quercus Prinus*, a new record, but the fungus causing the broom was not determined. A. L. S.

African Fungi.—M. BEELI ("Contribution nouvelle a l'étude de la Flore Mycologique du Congo," *Bul. Soc. roy. Bot. Belgique*, 1926, **58**, 203–16, 2 pls.). Beeli has listed two Mycetozoa and a number of Ascomycetes, but the greater number are Basidiomycetes. They were collected chiefly by Madame Goossens, mostly on dead wood in the forests. Twenty-one species or varieties are new to science. A. L. S.

Study of Parasitism.—PAUL A. YOUNG ("Penetration Phenomena and Facultative Parasitism in *Alternaria*, *Diplodia* and other Fungi," *Bot. Gaz.*, 1926, **81**, 258–78, 3 pls.). In fungi there exist obligate and facultative saprophytes and parasites. Most species of *Alternaria* are facultative parasites, and the aim of the paper is to determine the penetration phenomena, etc., of *Alternaria* and other dematiaceous fungi. Methods are described and detailed results are given as to the varying effects of inoculation on the host tissues. *Alternaria* gave rise to callosities on the inoculated wheat as well as stained rings or discs at the point of infection. Callosities were also formed in seedlings of a large number of other plants. The reactions between host and parasite are given; incidentally "200 new diseases which resulted from the cross-inoculations occurred under conditions very unlike field conditions."

A. L. S.

Study of Torulopsidaceæ.—R. CIFERRI ("Studi sulle Torulopsidaceæ," *Ist. Bot. Univ. Pavia Lab. Critt. Ital.*, 1925, Ser. 3, **2**, 129–46). A discussion as to the nomenclature, especially of *Torula*, which in fungi is a genus of Dematiaceæ and in medical mycology of Mucedinaceæ. Ciferri suggests the name *Torulopsis* for the latter in order to avoid the present confusion. A. L. S.

Monograph of Torulopsidaceæ with Red Pigments.—R. CIFERRI ("Monografia delle Torulopsidaceæ a Pigmento Roseo," *Tom. cit.*, 147–303, 5 pls.). After some introductory notes a first part deals with the history of the red-forming Torulas from Fresenius' species, *Cryptococcus glutinis*, with a red pigment, down to the present day, with a series of names and descriptions. Ciferri made many culture experiments and all details are given. The second part is devoted more particularly to the pathological character of *Torulopsis*. Full bibliographies of papers referring to these fungi are given. A. L. S.

Fungi of Bermuda.—FRED J. SEAVER ("Mycological Work in the Bermuda Islands," *Mycologia*, 1926, **18**, 187–8, 1 pl.). The writer gives a general account of our knowledge of fungi in Bermuda. Professor H. H. Whetzel spent a year in the employ of the Bermudan Government studying problems of plant pathology, making collections, etc. The predominating tree is the Bermuda Cedar, and a surprisingly large number of species grew on this endemic host. A. L. S.

Mississippi Fungi.—L. E. MILES ("New Species of Fungi from Mississippi," *Tom. cit.*, 163–8). The territory of the Mississippi is practically untouched by mycologists. The author now describes 13 new species of microfungi, Pyrenomycetes and Sphæropsideæ—most of these parasites—found infesting leaves of various trees or shrubs.

A. L. S.

Fungi Brigantini.—ROGER HEIM (*Paris, Bul. Soc. Mycol.*, 1926, **41**, 439–57, 3 pls., 8 text-figs.). The fungi described were collected in the valleys of the Durance and the Guisane in Dauphiné. The first study deals with *Agaricus compressus*, *A. odorus* and *A. jugis*, all of which he decides are synonymous with *Lentinus squamosus*, a very variable species living on several kinds of wood. A discussion follows as to the characters and systematic position of the genus *Wynnea* based on the species *W. atro-fusca*. A detailed account of *Sarcoscypha protracta* follows. A. L. S.

Fungi Brigantini.—ROGER HEIM and L. REMY ("Espèces nouvelles de Macromycètes subalpins du Briançonnais," *Tom. cit.*, 458–62, 3 text-figs.). Three new species are described and figured by the two authors: *Lentinus densifolius*, *Psilocybe aleuriata*, and *Acetabula æstivalis*, the latter distinguished by the rose-copper exterior of the cup. A. L. S.

Fungi that Live on Insects.—T. Petch ("Studies in Entomogenous Fungi: IX. *Aegerita*," *Trans. Brit. Mycol. Soc.*, 1926, 11, 50–66, 1 pl., 1 text-fig.). During an investigation of sooty mould of the orange in Florida, it was found that the larvæ and pupæ of the mealy wing (*Aleyrodes Citri*) were attacked by a brown fungus as well as by *Aschersonia*. The fungus develops in the body of the insect, and finally forms a dark stroma from which radiating hyphæ cover the leaf. A fungus almost entirely identical with the Florida species occurs in Ceylon and in New Zealand. Petch has made comparative and cultural studies of all the various forms known as *Aegerita Webberi*, and has published full details. He also gives an account of another parasite on coccids, *Septobasidium lanosum* Pat., from Tonkin, somewhat similar to *Aegerita*, but sufficiently different to keep the fungi distinct. Finally, an account is given of fungi parasitic on *Aegerita*. A. L. S.

Studies in Vegetation—Special Groups of Plants: A. Fungi.—J. Ramsbottom ("Aims and Methods in the 'Study of Vegetation,'" 1926, 1–23: A. G. Tansley and T. F. Chipp, Cambridge University Press). The author of this section of the work has given a general survey of the ecology of fungi. He treats first of soil fungi, their distribution and their importance as soil-formers in disintegrating organic compounds; Mycorrhiza and its connection with the larger fungi is also dealt with. The distribution of the larger fungi in pasture, woodland, or on special soils is outlined, aquatic forms such as *Saprolegnia* being included. Spore dissemination due to wind or to animal agency is discussed, and the question of parasitism is also reviewed, both of these factors being of great importance in the distribution of fungi. A. L. S.

Taxonomy of Fungi.—J. Ramsbottom ("Presidential Address," *Trans. Brit. Mycol. Soc.*, 1926, 11, 25–45). The address, as the title implies, was concerned with the arranging and naming of fungi. The author allows that taxonomy abounds in uncertainties, but there are a number of points which are secure. One of these is the specimen described by the maker of a species. Hence we get the term "type specimen." Ramsbottom goes on to discuss the methods of description and the limits of species. He then takes up the question of heterothallism, and the difficulties introduced by the culture methods where fungi are subjected to substrata undreamt of in natural conditions, and develop peculiarities very new to science. ' These are touched on by the writer. Finally, he concludes in the words of Asa Gray:—"Botanical classification, when complete, and correct, will be an epitome of our knowledge of plants." A. L. S.

Growth of Fungi.—B. L. Issatchenko and A. A. Egorova ("Observations sur la croissance du corps fruitier des Champignons," *Bul. Princip. Jard. Bot. Républ. Russe*, 1922, 21, 109–13; Russian with French Résumé). The observations were made on *Boletus rufus*: the stalk grew about 1·6 cm. in 24 hours, the pileus during the same time about 1·62 cm. The fungus persisted about 8–10 days. Greatest growth occurred in the stalk about the third or fourth day, in the pileus the fourth or fifth day. A. L. S.

Mycorrhiza of Angiopteris.—N. V. Stark ("Ueber die Mycorrhiza von Angiopteris Hoffm.," *Bul. Jard. Bot. Républ. Russe.*, 1925, **24**, 141–4; Russian with German Résumé). The fern examined grew in the Botanic Garden, Leningrad, and was about 70 years old. The young fleshy well-developed roots were free from Mycorrhiza. In the secondary small roots and in the fine rootlets, *Peronospora Stigeosporium Marattiacearum* (already described by West) was found. It was readily recognized by the beautiful yellow chlamydospores. A. L. S.

Experiments on Fungus Poisoning.—Norman Dobson ("The Toxicity of the Spores of *Tilletia Tritici* to Animals," *Trans. Brit. Mycol. Soc.*, 1926, **11**, 82–91). The toxicity of grain damaged by bunt or smut has been a much-debated point. The writer of the paper put the matter to the proof by feeding dogs, rabbits and guinea-pigs with food mixed with spores direct from bunted grains. "The result of this investigation, however, taking into account the lengthy period of the test, the large quantity of the spores administered, . . . justifies the conclusion that only in the most exceptional cases can the spores of *Tilletia Tritici* be regarded as injurious to animals; . . . it may be safely accepted that grain infected with bunt may be fed without injury to animals." A considerable bibliography of papers dealing with the subject is appended. A. L. S.

Reports on Fungus Poisoning.—E. Chauvin ("*Amanita porphyria* A. and S. est-elle vénéneuse?" *Paris, Bul. Soc. Mycol.*, 1926, **41**, 476–7). The author investigated the toxicity of the species by injection of animals. No bad effects were noted, but he deprecates the use of the species as an edible fungus.

Léon Azoulay ("Les empoisonnements par Champignons en 1925," *Tom. cit.*, 478–91). Azoulay writes an account of 17 cases of poisoning by fungi, the victims numbering 54, of whom 22 died. The poisonous fungi were *Amanita phalloides*, *A. verna* and *Psalliota xanthoderma*. All the different cases are described and commented on by Azoulay.

E. Martin-Sans ("Les empoisonnements dans le Sud-Ouest en 1925," *Tom. cit.*, 492–4). Martin-Sans reports 15 cases in his district. *Amanita phalloides* was again the poison agent in most cases, but bad effects also followed the consumption of *Boletus versipellis*, *Amanita pantherina*, and somewhat doubtfully *A. spissa*. A. L. S.

Storage Rot of Apples.—F. D. Heald and Roderick Sprague ("A Spot-rot of Apples in Storage caused by Botrytis," *Phytopathology*, 1926, **16**, 485–8, 1 text-fig.). The rot is first evident as spots appearing on the apples. Microscopic examination proved that the disease was due to a *Botrytis*, probably *B. cinerea*. The rot develops best at high temperatures, but without the spotting; the spotted appearance develops only at low temperatures. A. L. S.

Banana Disease.—O. A. Reinking ("Banana Freckle and Leaf Spot," *Mycologia*, 1926, **18**, 185–6). In Hawaii and the Philippine Islands the banana trees have been affected by a leaf-spot disease variously described as due to *Phoma Musæ* and *Macrophoma Musæ*.

Reinking considers that there is but one species which should be known by the latter name. The disease is very common in the Philippines.
A. L. S.

Study of Potato Scab.—G. B. SANFORD ("Some Factors affecting the Pathogenicity of *Actinomyces Scabies*," *Phytopathology*, 1926, 16, 525–47, 8 text-figs.). The aim of the research was to understand the influence of temperature, moisture, aeration and substratum on the development of the scab fungus. The results of experiments are given: temperature was not found to have any decisive influence; the fungus is a strong aerobe and requires oxygen in large quantities. The effect of manuring with green rye plants was not noticeable. The relation of bacteria to the disease was also studied. A. L. S.

Study of Colletotrichum.—W. SMALL ("On the Occurrences of a Species of *Colletotrichum*," *Trans. Brit. Mycol. Soc.*, 1926, 11, 112–37). The writer found in the course of his work in Uganda that one of the most frequent parasites encountered was *Colletotrichum Coffeanum*, so called because it was first found by him on *Coffea arabica*. Later similar fungi were found on a great variety of hosts all having common morphological features, and all regarded as the conidial form of *Glomerella cingulata*. Various cultures were made, and the results of cross-inoculation are described, and the different behaviour of the various stains is indicated. Small states that the fungus may be supposed to consist of numerous physiological strains, certain of which from time to time find suitable opportunities of adopting the kind of life which lies within their physiological capabilities. A. L. S.

Coffee Disease in Kenya.—J. MCDONALD ("A Preliminary Account of a Disease of Green Coffee Berries in Kenya Colony," *Tom. cit.*, 143–54). This new disease was reported in Kenya in 1922, and is now described by the author. It has caused great damage, but fortunately is limited to two districts. A small dark brown spot on the berries is the first symptom, and microscopic examination revealed the fungus to be identical with *Colletotrichum Coffeanum*. It attacks the coffee-berry alone, and these are soon destroyed; the stems and leaves are uninjured. The fungus is fully described as to its development both in nature and in artificial cultures, and the possible relationship to other fungi discussed. Methods of controlling the malady are described; a careful selection of seed is being instituted, so that immune varieties of the host may be selected for planting. A. L. S.

Fusarium Rot of Gladiolus Corms.—L. M. MASSEY (*Phytopathology*, 1926, 16, 509–23, 1 pl., 2 text-figs.). The lesions caused by *Fusarium* rot appear at the time of harvesting as small water-soaked spots. The rot which is primarily a disease of stored corms advances during storage. The corms when planted produce stunted plants, if any. A series of experiments have been undertaken to decide the effect of temperature, etc., on the development of the lesions; all these are set out at length. It was found that the fungus was *Fusarium oxysporum* var. *Gladioli*, var. nov., differing from the species in certain morphological characters and in its parasitism. It is believed that elimination of diseased corms and crop rotation would greatly reduce the extent of the disease. A. L. S.

Apple Scab Fungus.—J. E. Howitt and W. G. Evans ("Preliminary Report of some General Observations on Ascospore Discharge and Dispersal of Conidia of *Venturia inaequalis*," *Phytopathology*, 1926, **16**, 559–63). The writers have studied the effect of temperature on spore discharge and the consequent spread of infection; they have also considered the question of precipitation. They have proved that the temperature of the months January, February, and March has more influence on the development of the fungus and the maturing of the spores than has precipitation. Ascospores retain their vitality until August and even to a later date. Conidia may be freely scattered by wind from tree to tree in an orchard. A. L. S.

Leaf-spot of Peas.—Maurice B. Linford ("Black-leaf of Peas caused by *Fusicladium pisicola* n. sp.," *Phytopathology*, 1926, **16**, 549–58, 2 pls.). The disease appeared in Utah and caused considerable leaf-destruction in peas (*Pisum sativum*) at canning age. Lindford made a thorough study of the fungus, which appeared as dark elongate spots on the lower sides of leaves and on petioles and tendrils. Under conditions favourable to the development of the fungus great damage may be done, but under usual conditions it is not considered to be of great economic importance. A. L. S.

Fusaria on Banana.—O. A. Reinking ("*Fusaria* Inoculation Experiments. Relationship of various Species of *Fusaria* to Wilt and Colorado Disease of Banana," *Phytopathology*, 1926, **16**, 371–92, 8 text-figs.). By means of inoculation experiments Reinking has succeeded in determining Banana Wilt to be the attack of one *Fusarium* —*F. cubense*, which can be distinguished from all other species. He holds that it is present in the soil, and from the soil it enters the plant and produces disease. The parasitic form of *F. cubense* is not present in virgin soil or on lands on which no bananas have been grown, but once established in the soil it retains its virulence for many years. It is, however, possible that a wild saprophytic form of the fungus may be present and may adapt itself to banana plants and become parasitic. A. L. S.

Disease of Apples.—W. J. Dowson ("On a Core Rot and Premature Fall of Apples associated with *Sclerotinia fructigena*," *Trans. Brit. Mycol. Soc.*, 1926, **11**, 155–61, 1 pl., 1 text-fig.). The fruits of an early ripening apple tree at Wisley were noticed to have fallen in great numbers, and that some remaining on the tree were yellower than the rest. All such apples on the ground and on the tree were found to be rotten at the core, from the eye inwards. The disease was allowed to develop on the apples and *Monilia* types of fructification were formed, not differing from *Monilia fructigena*. Inoculation experiments were also carried out with success. It was not sufficiently determined how the apples had become diseased, but evidently infection had spread from the "eye" inwards. Possibly infection had occurred while in the blossom stage. A. L. S.

Disease of Trees.—F. T. BROOKS and W. C. MOORE ("Silver-leaf Disease: V.," *J. Pomology Hort. Sci.*, 1926, 5, 61–97). This disease, due to the fungus *Stereum purpureum*, is best known as a wound disease of plum-trees, which, though attacking the wood, manifests its presence by the silvering of the leaves. The disease has been the subject of continual work and observation for many years. The object of the present paper is to decide at what stage tree-wounds cease to be liable to infection, and what are the best substances for the protection of wounds. Roses, rhododendrons, as well as fruit-trees (apples, pears, and especially plums), have been found to be affected by silver-leaf' The experiments made both in inoculation and in prevention are fully described. The most effective remedy is to remove all traces of *Stereum purpureum* from the neighbourhood, and following that to see to the healthy growth of the fruit-tree. "Good cultivation and effective drainage are essential if the trees are to have a reasonable chance of throwing off the disease." In the course of experimentation it was found that trees—or rather wounds—were liable to infection throughout the year, except in June, July and August, probably because "a gum-barrier" was formed in these months below the exposed surface. Old wounds are not infectible, nor does *Stereum purpureum* follow in the wake of other diseases such as canker. The amount of natural recovery is greater than was supposed at one time, and is correlated with the health and vigour of the tree. Resistance is due to the formation of "gum-barriers" in the tissues, which checks the further growth of the fungus. It has also been shown that the fungus secretes some substance which, apart from the living organism, produces some of the symptoms associated with the later phases of silver-leaf disease when injected into healthy trees. A. L. S.

Defoliation of Conifers.—MALCOLM WILSON and J. S. L. WALDIE "*Rhizosphæra Kalkhoffii* Bubak as a Cause of Defoliation of Conifers," *Edinburgh, Trans. R. Scot. Arbor. Soc.*, 1926, 34–6, 2 pls.). The authors state that "the defoliation of the spruce has become a serious problem in this country." They have found that the cause of the trouble is the presence of the fungus *Rhizosphæra Kalkhoffii*, a parasite on the needles. It has been found on a number of conifers—*Picea*, *Abies* and *Pinus*. The disease is first evident in May, later the fructifications—pycnidia with small colourless spores—appear. A description is given of the whole development of the fungus, which the authors consider has been imported in recent years from the Continent. A. L. S.

Rhabdocline Pseudotsugæ Syd.: A New Disease of the Douglas Fir in Scotland.—MALCOLM WILSON and MARY J. F. WILSON (*Tom. cit.*, 37–40, 2 pls.). The disease is due to the above Discomycete which attacks the leaves and causes defoliation. A description of the fungus and of the disease is given. The authors consider that it has been recently imported; this is its first European record. A. L. S.

Progress of Plant Diseases.—N. L. ALCOCK ("Successional Disease in Plants as shown in Willow Rods," *Trans. Brit. Mycol. Soc.*, 1926, 11, 161–7, 1 text-fig.). The author describes from her own observations the fungal attacks to which willows are subject. The first to be noted was willow scab, *Fusicladium saliciperdum*, a strong parasite forming dark blotches on the stem. *Cryptomyces maximus*, also a parasite, followed: it forms long black cushions on the bark girdling the twig. *Scleroderris fuliginosa*, a very destructive fungus, entered by the scars and lesions of the previous parasite. Lastly appeared *Myxosporium scutellatum*, on the injured or dead twigs; it is practically a saprophyte, but it hastens the destruction of the willow rods. The last-named fungus has now been placed by Petrák in a new genus, *Cryptosporiopsis*. A. L. S.

Lichens.

Lichens from East Gothland.—J. HULTING ("Lavar från Östergötland," *Ark. Bot.*, 1926, **20**, N. 2, 1–80). Hulting gives a sketch of previous collections in the island from the time of Acharius Swartz and Westring down to the recent work of Du Rietz, Hedlund, Malme and Magnusson. Zahlbruckner's arrangement has been followed, and locality and habitat are recorded. A very large number of genera are represented in thirty-three families. A. L. S.

Lichens from Finland.—VELI RÄSÄNEN ("Die Flechtenflora des Gebiets Ostrobothnia Borealis, Susmalaisen Elain-ja Kasvitieteellisèn seuran *Vanamon Julkaisuja*," 1926, **3**, N. 8, 268–348). Räsänen has made a complete catalogue of lichens from the Northern East Bothnia region. During ten years of collecting he has listed 589 different forms. The total number is 600. A number of new species and varieties are included. Localities whether shaded or well-lighted are indicated, as well as the substratum and the frequency of occurrence or otherwise. A. L. S.

Patagonian Lichens.—G. EINAR DU RIETZ ("Einige von Dr. M. Gusinde gesammelte Flechten aus Patagonien und dem Feuerlande," *Ark. Bot.*, 1926, **20**, B. N. 1, 1–6). The collection was made by Gusinde in 1919–1924. Nineteen species are included, of which one, *Pseudocyphellaria dubia*, is new to science. Most of them had already been recorded from Patagonia or Tierra del Fuego, but various biological notes are added by the author. A. L. S.

Lichens from Teneriffe.—C. F. E. ERICHSEN ("Beiträge zur Lichenflora von Teneriffa," *Hedwigia*, 1926, **66**, 275–82). Erichsen gives first a sketch of work done on the lichens of the Canary Islands; those he has determined were collected during the war years by Lindinger, and mostly from trees. The list is only a small one, but it contains a large percentage of new species; twelve lichen genera are represented. A. L. S.

Mexican Lichens.—EDV. A. VÄINIO ("Lichenes Mexicani a F. M. Liebmann annis 1841–1843 collecti, in Museo Hauniensi asservati," *Dansk. Bot. Ark.*, 1926, 4, N. 11, 1–25). The collection was made by Liebmann, 1841–43, along with an immense number of other plants, 363 numbers being lichens. The centre of his work was Orizaba, from which he made many trips. Vainio has now worked through the lichens, giving names, habitats and localities. In nearly all the groups he has found new species, which are described, among them new species of *Usnea*, *Ramalina*, *Roccella*, etc. *Lecanora* is represented by four more or less familiar species and one new to science. A. L. S.

Brazil Lichens.—GUST. O. A. N. MALME ("Die Pannariazeen des Regnellschen Herbars," *Arkiv Bot.*, 1926, **26**, N. 2, 1–28). Five genera are included in the Pannariaceæ—*Parmeliella*, *Pannaria*, *Psoroma*, *Coccocarpia* and *Erioderma*. There are a number of new species of *Pannaria* and *Psoroma*. The collections are mostly from maritime states. A. L. S.

Lichens of the Tintern Foray.—H. H. KNIGHT (*Trans. Brit. Mycol. Soc.*, 1926, 11, 9–10). Carboniferous Limestone prevailed in the Tintern district along with Old Red Sandstone rocks, but calcareous lichens were not so plentiful owing to the dense woodland: one interesting find was *Opegrapha paraxanthodes*, a lichen of shady calcareous rocks. A list is given of all the lichens found and determined in the district. A. L. S.

Lichens of the Dublin Foray.—A. L. SMITH and M. C. KNOWLES (*Tom. cit.*, 18–22). The length of time (six days) and the favourable collecting ground gave the opportunity for the collection of a large and varied series of lichens, altogether 191 species and varieties, five being new to Ireland. An account is given of the ground traversed, and of the different types of substratum. A complete list is appended. A. L. S.

Studies in Vegetation—Special Groups of Plants: B. Lichens.—J. RAMSBOTTOM ("Aims and Methods in the 'Study of Vegetation,'" 1926, 23–36; A. G. Tansley and T. F. Chipp, Cambridge University Press). Emphasis is laid on the significant and important part played by lichens in covering the earth with vegetation. A short sketch is given of their peculiar constitution which enables them to face many different and extreme conditions of life; their means of dispersal is touched on, and the different types of lichens are given with their addiction to some generally restricted substratum. Their colonization of bare rocks, in succession, one kind after another, is described, as are also specialized localities, such as maritime rocks, sand-dunes, lakes and streams, forests, heaths and tundra. The aim of the paper is above all to indicate lines of ecological study. A. L. S.

Lichens of an Erratic Boulder.—CH. MEYLAN ("La Flore bryologique et lichénologique du bloc erratique de la Grange-de-la-Côte," *Lausanne, Bul. Soc. Sci. Nat.*, 1926, **56**, 165–72, 2 text-figs.). The interest of the study lies in the fact that the boulder in question is formed of gneiss and lies on a calcareous rock, both of them exposed to the south and to full sunshine. The lichens are described from the different positions and faces of the boulder. Meylan listed 26 lichens on the boulder and 28 on the calcareous support. Of these only six are common to both, a striking example of the influence of the substratum, i.e. of its chemical properties. A. L. S.

Jura Lichens.—CH. MEYLAN ("Nouvelle contribution a la connaissance des Lichens du Jura, avec quelques indications de localités des

Alpes," *Tom. cit.*, 173–8). This paper is a continuation of work published in 1922; many of the species now listed are additions to the lichen-flora of the Jura; special attention was paid to erratic boulders. Meylan has added a list of fungal parasites found on the lichens.

A. L. S.

Contribution to the Lichen-Flora of White Russia.—A. N. Oxner ("Beiträge zur Flechtenflora Weissrusslands," *Bul. Jard. Bot. Kieff*, 1924, **1**, 27–36; Russian, with German Résumé). The author gives an account of soil associations. The species were collected in Minsk and in Igumen. Several forms are new to the country. A. L. S.

New and Rare Lichens from the Ukraine.—A. N. Oxner ("Neue und bis jetzt für die Ukraine wenig bekannte Flechtenarten," *op. cit*, 1925, **2**, 20–8; Russian, with German Résumé). The author gives a descriptive list of eleven species, most of which are new to the country.

A. L. S.

New Lichens from the Ukraine.—A. N. Oxner ("Neuheiten der Flechtenflora der Ukraine," *op. cit.*, 1925, **3**, 8–21; Russian, with German Résumé). The author lists twenty-one species not hitherto recorded from the Ukraine. Some of those usually sterile were found in fruit; the geographical range of other well-known species has been extended. A. L. S.

Siberian Lichens.—A. N. Oxner ("Les Lichens du Transbaical. collectés en 1916 par G. G. Kanewskii," *Ucrainian Bot. Rev.*, 1926, **3**, 1–10; Russian, with French Résumé). The lichens of this list, numbering twenty-nine species, were collected on the further side of Lake Baikal, in the district of Bargouzine, on the peninsula of St. Noss. *Cetraria odontella* and *C. Richardsonii* were found in fruit. Systematic notes are given about other species and forms. One new species, *Cladonia Kanewskii*, is described. A. L. S.

Lichen Dyes.—A. Lorrain Smith (*Trans. Brit. Mycol. Soc.*, 1926, **11**, 45–50). The writer has given an account of the substances formed in lichens termed lichen-acids, especially of those that have been used in the dyeing industry from ancient times down to the present day. The most renowned is orchil, which gives a purple colour, also known as litmus and cudbear. The history of these dyes is outlined, and the methods of collecting and preparing the lichens are indicated. Certain lichens give various shades of brown and yellow, and these also are discussed in the paper. A. L. S.

Mycetozoa.

Study of Acrasieæ.—R. A. Harper ("Morphogenesis in Dictyostelium," *Bull. Torrey Bot. Club*, 1926, **53**, 229–68, 3 pls.). Harper states that the view that Acrasieæ are primitive slime-moulds is supported by abundant evidence. He thinks, however, that slime-moulds might be equally classed as aggregation forms. He has adopted the term sorus for the spore mass, the stalk being the sorophore; the entire structure is regarded as the sorocarp. The structure of the sorocarp is first described—in *Dictyostelium* and in *Polysphondylium*, both of them stalked forms. Cell-growth and multiplication are followed from the liberation of the amœbæ: "Growth and cell-division are first completed as independent processes"; then follow aggregation stages with the formation of the sorophore and the sorus, with variations in curving and branching of the sorocarps. Finally, there is the statement that "the morphogenetic processes by which the sorocarp is an organized out of the discrete myxamœba are matters of cell responses in which the cell behaves as a unit organism. The sorocarp is organized aggregate of myxamœbæ, but the myxamœbæ is a biologic unit and not an aggregaté of organisms." Harper has further pointed out that "no promorphological representation of the mature sorocarp in the spore is possible." It is the first amœbæ to mature that collect to form the sorocarp, and the first mature which build up the stalk; it is they that initiate the morphogenetic processes. A. L. S.

New Mycetozoon.—PHILIP M. JONES ("Structure and Cultural History of a Mycetozoan found in Tobacco Plants with Mosaic-like Symptoms," *Bot. Gaz.*, 1926, **81**, 446–59, 4 pls., 2 text-figs.). The organism was cultured from tobacco plants with mosaic-like symptoms: sections of the leaves show the plasmodium stage within the plant-cells. In culture the organism has a flagellate and an amœboid stage, and forms gametes, plasmodia, free spores and cyst spores. Jones has provisionally described the mycetozoon as a species of *Plasmodiophora*—*P. tabaci.* Other plants affected with mosaic were also examined, and amœbæ and flagellates differing somewhat from those of *P. tabaci* were formed in cultures from tomato plants, from potato plants affected with leaf roll, and from intestines of aphids that had fed on these diseased plants. It was not possible to grow the organism in cultures free from bacteria. Pure cultures did not live long; the bacteria seem to be part of its food. A. L. S.

Mycetozoa of the Dublin Foray.—G. LISTER (*Trans. Brit. Mycol. Soc.*, 1926, **11**, 22–3). Conditions were not too favourable for the development of these organisms at the time of the Foray. The weather for some time had been fine and dry, and the rain too recent. Twenty-seven species were obtained, two of which were new records for Ireland; one of these, *Lachnobolus congestus*, was found at Kilruddery. Sixteen genera are represented in the list. A. L. S.

Notes on Irish Mycetozoa.—G. LISTER (*Tom. cit.*, 23–4). A list of sixty-four species of Mycetozoa in Ireland was published in the Clare Island Survey in 1912. Many interesting gatherings have been recorded since that date and the additional species are listed. The number for Ireland is now ninety-eight. A. L. S.

Mycetozoa of the Ukraine.—MARIA ZELLE ("Beiträge Schleimpilze der Ukraine," *Bul. Jard. Bot. Kieff*, 1925, **2**, 81–9; Russian, with German Résumé). The writer has summarized the literature dealing with Ukrainian Mycetozoa, and has given the species which were collected in Wolhynia, Podolia, Kieff and Tchernigoff. The number listed is 63, of which 31 are new to the Ukraine, and 10 of these new to Russia. A. L. S.

TEXTILES.

Textile Analytical Microscopy.—W. Garner (*J. Soc. Dyers and Cols.*, 1926, 269–72). To cut a section of a textile fibre, the author supports the fibre on a special wire frame (illustrated in the paper) and then soaks it for a short while in filtered beeswax at 100° C. The frame is then placed in a brass tube filled with liquid wax, and by means of a screw adjustment the fibre is kept straight during the cooling of the wax. The wax pencil is now removed from the tube and a ⅜-in. length is fixed in the cup of a Cambridge microtome. The ribbon section is mounted on a slide which has been smeared with 1 p.c. gelatin solution. After drying in the oven and cooling, the wax is removed with cold petroleum ether. Final mounting is in Canada balsam. The best thickness for textile fibre sections is 10 μ. The examination of a cross-section of a fibre is a great help to its identification, especially in the case of viscose silk fibres. Details are given as to methods of sublimation, sifting, gravity separations, etc., as used in textile microscopical work. A short description is also given of the microscopical characteristics of various fibres. A. H.

Damaged Cotton Hairs, Microscopical Examination of, by the Congo Red Test and Swelling Test of Flemming and Thaysen.—T. B. Bright (*Mem. Shirley Inst.*, 1926, 141; *J. Soc. Dyers and Cols.*, 1926, 323). Damaged cuticle is stained more deeply by congo red (when the whole fibre has been swollen by caustic soda) than the undamaged fibre. 0·1 grm. of cotton is put into water and freed from air so as to thoroughly wet the fibre, and placed in 11 p.c. solution of caustic soda for 5 minutes. After a rapid wash in water the fibre is stained in 2 p.c. congo red for 6 minutes, and again washed. The stained fibre is teased out under 18 p.c. caustic soda, and mounted in this medium for examination with a ⅔-in. objective and × 10 eye-piece. The test is not satisfactory for detecting sulphuric acid damage unless very severe. The relative efficiencies of the congo red and swelling tests are not comparable as they vary with the material examined.

A. H.

NOTICES OF NEW BOOKS.

Histological Technique. By H. M. Carleton. London: Humphrey Milford (Oxford University Press), 1926. 8vo. Pp. 388, with 17 text-figures.

In this volume the methods employed in the microscopical examination of mammalian organs and also protozoa and bacteria are set out on distinctly novel lines, resulting in the most practical manual it has been our fortune to encounter. A succinct description of the ultimate cell and its component parts, followed by a résumé of the physico-chemical attributes of protoplasm, places before the reader a definite conception of the entity with which subsequently he has to deal. Part II is a reasoned account of fixation, dehydration, clearing, embedding and section-cutting, followed by chapters on the theory and practice of staining, calculated to lighten the labours of laboratory teachers and to guide the steps of the solitary worker. The advice to beginners that "Staining is an art which can only be acquired by individual practice . . ." is balanced by the promise that "With practice, staining methods become practically reflex."

Part III deals with accessory methods of examination, e.g. "darkground illumination," where principles properly precede practice; histochemical tests, of which the author has made a wise selection; injection methods and intra-vitam staining. Then come methods for special organs, tissues and cell components in Part IV, to which almost a third of the volume is devoted; followed by Part V, dealing with histopathological processes and their special technical needs. Finally, methods applicable to the investigation of parasitic worms, protozoa and bacteria are set out, subjects but rarely found in histological manuals, and all the more welcome on that score. This portion is concise—of a brevity that perhaps is not altogether commendable; and in connection with the bacteriological section we should prefer Dr. Carleton to adhere to one method or the other of designating micro-organisms, and to adopt a more satisfactory method for collecting serum for the demonstration of the *Spironema pallidum.*

The volume terminates with a page of references to some English, French and German text-books; an exhaustive author's index, and a very adequate subject index. The work on the whole is so praiseworthy (and in this commendation the publishers also share) that we have not attempted to stress the few obvious omissions and minor blemishes.

J. E.

Norwegian Mountain Algæ. By K. Münster Strøm. 1926. 263 pp., 6 text-figs. and 25 plates.

Microscopic Fresh-water Life. By F. J. W. Plaskitt. 1926. xi + 278 pp., 286 figs. and plates. Published by Messrs. Chapman & Hall, 11 Henrietta Street, Covent Garden, W.C.2. Price 18*s*. 6*d*. net.

Researches on Hookworm in China. By W. W. Cort, N. R. Stoll and others. 1926. viii + 398 pp., 7 plates and numerous text-figs. Published by the American Journal of Hygiene, Baltimore, Maryland, U.S.A.

Das Polarisationsmikroskop. By Hermann Ambronn and Albert Frey. 1926. 194 pp., 48 text figs. and 1 plate. Published by Richard Zsigmondy, Göttingen.

Enzyklopädie der Mikroskopischen Technik. Volume II. Fib-Myx. Edited by Prof. Dr. Rudolf Krause. 1926. 208 figs, 11 coloured and 7 black plates. Published by Messrs. Urban & Schwarzenberg, Berlin, N. 24. Price 45 Marks.

Proceedings of the Pan-Pacific Science Congress (Australia), 1923. Vol. 1: xvii + 1024 pp., with maps and text-figs. Vol. 2: viii + 1025–1667 pp. Edited by Gerald Lightfoot, M.A.

Synonymy of the British Non-Marine Mollusca. By A. S. Kennard, F.L.S., and B. B. Woodward, F.L.S. 1926. xxiv + 447 pp. Published by the British Museum (Natural History), Cromwell Road, S.W.7

A Monograph of the British Lichens. Part II. By A. Lorrain Smith, F.L.S. 1926. viii + 447 pp. 63 plates. Published by the British Museum (Natural History), Cromwell Road, S.W.7

British Mosquitoes and their Control. By F. W. Edwards and S. P. James, M.D. 1925. 27 pp. and 4 figs. Published by the British Museum (Natural History), Cromwell Road, S.W.7

Index Animalium. Part VII, Part VIII, Part IX, 1801–50. By Carolo Davies Sherborn. Part VII, 1925. 317 pp. Part VIII, 1925. 238 pp. Part IX, 1926. 240 pp. Published by the British Museum (Natural History), Cromwell Road, S.W.7. Price 10*s*. each part.

PROCEEDINGS OF THE SOCIETY.

AN ORDINARY MEETING

OF THE SOCIETY WAS HELD AT 20 HANOVER SQUARE, W.1, ON WEDNESDAY, OCTOBER 20TH, 1926, DR. JAMES A. MURRAY, PRESIDENT, IN THE CHAIR.

The **Minutes** of the preceding Meeting were read and confirmed.

The nomination papers were read of seven Candidates for Fellowship.

New Fellows.—The following were elected as Ordinary Fellows of the Society:—

Robert Bogue.
Alfred G. Rayner.
Miss Muriel Townley.

The **Deaths** were announced of:—

Dr. G. P. Bate. Elected 1874.
Dr. A. Dashwood-Howard. Elected 1891.
Mr. J. Hixon Irving. Elected 1924.
Mr. K. L. Matthews. Elected 1925.
Dr. A. J. Ochsner. Elected 1887.

A vote of sympathy with the relatives was passed.

Donations were reported from:—

Mr. W. E. Watson-Baker and Mr. C. F. Hill—
A Ross Radial Microscope.
Mr. Albert D. Michael—
A No. 1 Powell and Lealand Microscope and Accessories.
A Swift Challenge Binocular Microscope " "
A Swift Portable Binocular Microscope " "
A Swift Stephenson Binocular Microscope " "
A Swift Dissecting Binocular Microscope " "

Messrs. Urban and Schwarzenberg—
"Enzyklopädie der Mikroskopischen Technik." Vol. II.

Trustees of the British Museum—
"Synonymy of the British Non-Marine Mollusca." (Kennard and Woodward.)
"British Mosquitoes and their Control." (Edwards and James.)
"British Lichens." II. (Smith.)
"Index Animalium," Parts VII, VIII, IX. (Sherborn.)

Paul Lechevalier—
"Faune de France. 12. Diptères." (Séguy.)

Clarendon Press—
"An Introduction to Experimental Embryology." (G. R. de Beer.)

The Optical Society—
"Subject Index of the Transactions of the Optical Society." (A. F. C. Pollard.)
"The Decimal Bibliographical Classification of the Institut International de Bibliographie." (A. F. C. Pollard.)

Akademische Verlagsgesellschaft—
"Polarisations-Mikroskop." (Ambronn-Frey.)

Proceedings of the Pan-Pacific Science Congress (Australia). Vols. I, II.

A vote of thanks was accorded to the donors.

Exhibit.—Mr. Scourfield made an exhibit of the Sulphur Bacterium, *Chromatium okenii*, and was thanked for the same.

The following papers were read in title :—

Prof. E. Ghosh, M.Sc., M.D., F.Z.S., F.R.M.S.—
"A New Classification of Ciliata."

Mr. B. K. Mullick, M.Sc.—
"Notes on some Rotifers from India."

The following papers were read and discussed :—

Dr. J. E. McCartney, M.D., D.Sc.—
"The Filterable Viruses."

Dr. A. Piney, M.D., Ch.B., M.R.C.P., M.R.C.S., F.R.M.S.—
"A Method of Silver Impregnation of Zenker-fixed Paraffin Sections."

Hearty votes of thanks were accorded to the authors of the above papers.

The business proceedings then terminated.

AN ORDINARY MEETING

OF THE SOCIETY WAS HELD AT NO. 20 HANOVER SQUARE, W.1, ON WEDNESDAY, NOVEMBER 17TH, 1926, DR. JAMES A. MURRAY, PRESIDENT, IN THE CHAIR.

The **Minutes** of the preceding Meeting were read and confirmed.

The nomination papers were read of three Candidates for Fellowship.

New Fellows.—The following were elected as Ordinary Fellows of the Society :—

William A. F. Balfour-Browne, M.A., F.R.S.E., F.Z.S., F.E.S.
Albert Bruff.
W. J. Dunne.
Alfred Grainger-Shackles.
George H. Needham, M.Sc.
John Tomlison Rigby.
A. Eric J. Vickers, M.Sc., A.I.C., F.C.S.

The **Death** was announced of :—

Mr. F. J. W. Plaskitt. Elected 1906.

A vote of sympathy with his relatives was passed.

A **Donation** was reported from :—

Messrs. Chapman and Hall, Ltd.—
"Microscopic Fresh-water Life." (Plaskitt.)

A vote of thanks was accorded to the donors.

The following papers were read and discussed :—

Dr. H. A. Baylis—
"PWDRE SER."—The "Rot of the Stars."

Mr. M. T. Denne, O.B.E., F.R.M.S.—
"A New Apparatus for Casting Paraffin Imbedding Blocks."

Dr. C. Tierney, D.Sc., F.L.S., F.R.M.S.—
"Caballero's Technique for Mounting Diatom and other Type Slides."

Votes of thanks were accorded to the authors of the above papers.

The business proceedings then terminated.

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Shwegyin Rubber Estate, Sunthaik, Lower Burma.
1886 Ewell, Marshall D., M.D.
749, *Tate-avenue, Memphis, Tenn., U.S.A. (May* 1 *to Nov.* 1*), and Gulf View, Treasure Island, Osprey, Fla., U.S.A. (Nov.* 1 *to May* 1). (See Honorary Fellows.)
1897 Eyre, John William Henry, M.D., M.S.Durh., D.P.H., F.R.S.E. —EDITOR.—PAST PRESIDENT. *Professor of Bacteriology in the London University.*
*Bacteriological Laboratories, Guy's Hospital, S.E.*1, 62, *Wimpole-street, W.*1, *and The Warren, Tulse-hill. S.W.*2

1921 Falkner, Herbert John.
Gyfu, Barton, St. Mary Church, Torquay.
1883 *Fawcett, John Edward.
Heron-court, Farnham, Knaresborough.
1917 Fendick, Ernest A.
Wicklewood, 22, *Finedon-road, Wellingborough.*
1909 Ferguson, Arthur Duncan.
British Guiana Bank, Georgetown, Demerary, British Guiana.
1925 Findlay, George Marshall, M.D.
Imperial Cancer Research Fund, 8, *Queen's-square, W.C.*1

Elected.
1919 Fleuret, John B.
47, Walsingham-road, Hove.
1921 Flower, John W.
35, Surrey-street, Strand, W.C.2
1917 Fotheringham, William.
11, Dysart-road, Kirkcaldy.
1921 Frith, James Stretton, A.I C., A.M.S.T
Ascog, Thelwall, Warrington.
1923 Fry, J. Eric D.
Lloydminster, Sasks., Canada.

1912 Gadd, Arthur.
115, Atwood-road, Didsbury, near Manchester.
1918 Garbutt, Ernest Chalders.
York-house. St. Ives, Cornwall.
1923 Gardiner, Percy Cyril.
111, Lansdowne-road, Tottenham.
1919 Garnett, John Benbow.
309, Oxford-road, Manchester.
1920 Gatenby, James Bronté, B.A., D.Phil.(Oxon), D.Sc.(Lond.).
Professor of Zoology, Trinity College, Dublin.
1922 Gater, Bossley Alan Rex, B.A.
Department of Agriculture, Kuala Lumpur, Selangor, Federated Malay States.
1922 Gates, R. Ruggles, M.A., Ph.D., F.L.S., *Professor of Botany in the University of London, King's College, Strand, W.C.2*
1925 Gay, Alfred D., F.C.S., M.S.C.I.
49, Thornlaw-road, West Norwood, S.E.27
1921 Ghosh, Ekendranath, M.Sc., M.D., *Professor of Biology.*
Medical College, Calcutta, India.
1924 Gibbons, Arthur.
Dunsfold, Surrey.
1902 Gibson, Joseph.
Elmfield, Psalter-lane, Sheffield.
1892 Gifford, James William.
Oaklands, Chard, Somerset.
1921 Gillings, Horace Clifford.
48, Hertford-street, Cambridge.
1921 *Gilpin-Brown, Leslie George.
Clanage, Bishop's Teignton, S. Devon.
1899 Gleadow, Frank.
Bakeham-house, Englefield Green, Surrey.

Elected.
1923 Glover, Arthur Walker.
P.O. Box 7347, Johannesburg, S. Africa.
1912 Glover, Samuel.
Olive Mount, St. Ann's, St. Helens, Lancashire.
1904 Goadby, Sir Kenneth Weldon, K.B.E., M R.C.S., L.R.C.P.
83, *Harley-street, W.*1
1909 Gordon, Fred. William.
51, *East 42nd Street, New York City, U.S.A.*
1922 Gosling, George Walker.
6, *Francis-road, West Croydon, Surrey.*
1920 Graham, Joseph, B.Sc.
Glen Hurst, Corbridge-on-Tyne.
1919 Grant, Ernest Henry.
3 *and* 4, *Great Winchester-street, E.C.*2
1923 Gravelle, Philip O.
114, *Prospect-street, South Orange, New Jersey, U.S.A.*
1904 Griffiths, Waldron.
1, *Cecily-hill, Cirencester.*
1924 Gurr, George Thomas, F.C.S.
136, *New King's-road, S.W.*6
1912 Gurrin, Gerald Francis.
59, *Holborn-viaduct, E.C.*1
1902 Güssow, Hans Theodore.
Chief, Division of Botany, Dominion Experimental Farm, Ottawa, Canada.

1919 Hadfield, Sir Robert A., Bart., D.Sc., F.R.S., F.Inst.P.
22, *Carlton-house-terrace, S.W.*1
1923 Hagelstein, Robert, *President, New York Microscopical Society.*
165, *Cleveland Avenue, Mineola, New York, U.S.A.*
1893 Hägler, Elmer Ellsworth, M.D.
The Hägler Building, 401, *East Capitol-avenue, Springfield, Illinois, U.S.A*
1912 Hall, Rev. Charles A.
"*Clynder,*" 29, *Roe lane, Southport.*
1921 Hall, John Thomas, L.D.S., R.C.S.
Stoke Prior, Poole-road, Bournemouth.
1920 Hall, T. D. Tuton.
Technical School, Rochdale.
1921 Hall, William Ewart.
Swanspool House, Wellingborough.
1924 Hamilton, Thomas Dalling.
Royal College of Physicians Laboratory, 2, *Forrest-road, Edinburgh.*
1919 Hampshire, Percy.
5, *Kensington-terrace, Leeds.*

Elected.

1923 Hannam, James William.
8, *Park-terrace*, *Otley*, *Yorkshire*.

1919 Harper, Capt. Raymond Sydney, M.R.C.S., L.R.C.P., R.A.M.C.
86, *First Avenue*, *Hove*, *Sussex*.

1905 Harris, Charles Poulett, M.D. (Lond), M.R.C.S., L.R.C.P.
192, *Lower Addiscombe-road*, *Croydon*, *S.E.*

1920 Harris, William Charles, F.C.S.
Tayside, *Mill Park*, *Hornchurch*, *Essex*.

1915 Hartland, Albert J.
22, *Cambridge-road*, *King Williams Town*, *Cape Province*, *South Africa*.

1925 Hartley, Isaac
16, *Fern-bank*, *Nelson*, *Lancs*.

1867 *Hartree, William, Associate Inst. C.E., F.Z.S.
Holmwood, *Torquay*.

1911 Hartridge, Hamilton. M.D., Sc.D.
King's College, *Cambridge*.

1925 Harvey, Leslie A., A.R.C S , B Sc., D.I.C.
Zoology Department, *The University*, *Edinburgh*.

1919 Hawksley, Charles Worthington.
83, *Wigmore-street*, *W.*1, *and* 13 *Alma-square*, *St. John's-wood*, *N.W.*8

1916 Hazeldine, Frederick James.
Barnfield, *South Godstone*, *Surrey*.

1909 Heath, Charles Emanuel.
28, *Loughborough-road*, *Brixton*, *S.W.*9

1909 Heath, Ernest.
Clidga, *Sennen*, *Cornwall*.

1922 Hecht, Godfrey Emil.
4, *Avenue-road*, *Regent's Park*, *N.W.*8

1923 Hendrickson, Arthur V., F.I.C., F.C.S.
15, *Charleville-circus*, *Sydenham*, *S.E.*26

1917 Hensman, Leonard Newton, Ph.C., M.P.S.
2, *Killarney-road*, *Wandsworth*, *S.W.*18

1889 Hepworth-Collins, Walter, F.G.S., F.C.S.
Junior Constitutional Club, *Piccadilly*, *W.*

1891 Heron-Allen, Edward, F.R.S., F.L.S., F.G.S., F.Z.S., M.R.I.A., etc.—PAST PRESIDENT.
"*Large Acres*," *Selsey-bill*, *Sussex*.

1921 Hewison, Rev. G. H., M.A.
Marr Vicarage, *Doncaster*.

1910 Hewlett, Richard Tanner, M.D., F.R.C.P., D.P.H.
Professor of Bacteriology. *Bacteriological Laboratory*, *King's-college*, *Strand*, *W.C.*, *and The Acre*, *Crawley Down*, *Sussex*.

1904 Hill, Cyril Francis, M.Inst.M.M., A.Inst.P.—HON. TREASURER.
Moore, *Warrington*.

1881 *Hill, Joseph Alfred, F.L.S.
St. Bees, *Northumberland-road*, *Leamington*.

Elected.
1920 Hill, W. Basil, F.C.S.
Eastfield, Stockton-lane, York.
1906 Hiscott, Thomas Henry.
16, *Woodville-road, Ealing, W.*5, *and* 5, *Stone-buildings, Lincoln's Inn, W.C.*2
1923 Hobson, A. D., B.A.
Department of Natural History, The University, Edinburgh
1922 Hobson, Herbert, F.C.S.
11, *Whalley-avenue, Whalley Range, Manchester*
1922 Hodgson, Leonard Stanley.
"*San Remo,*" *Ecclesall-road South, Ecclesall, Sheffield.*
1921 Holder, J. T.
114 *Pepys-road, S.E.*14
1922 Hollis, George Thomas.
6, *Delcourt-mansions,* 31, *Rosendale-road, West Dulwich, S.E.*21
1921 Holt, Alfred, F.C.S.
76 *Nipper-lane, Whitefield, near Manchester.*
1925 Holz, Herman Adolphe.
17, *Madison-avenue, New York.*
1920 Hornyold, Professor Alfonso Gandolfi, D.Sc.
Museo Naval, San Sebastien, Spain.
1921 Horton, William.
7, *Linnet-lane, Liverpool.*
1918 Hoseason, Captain William Sandford.
Harbour Master, Evelyn-house, Apollo Bunder, Bombay, India.
1917 Howard, Henry J.
6, *College-road, Norwich.*
1918 Hughes, Owen Lloyd.
The Council School, Trefnanney, Meiford, S.O., Montgomeryshire.
1911 Huish, Charles Henry.
"*Summerhill,*" 79, *Station-road, Redhill, Surrey.*
1922 Hulls, Leonard G., F.C.S., etc.
"*Rax,*" *Chidham, near Emsworth, Hants.*
1921 Humphery, William Overton, M.I.M.E., P.A.S.I., M.R.San.I.
Pudding Norton, Fakenham, Norfolk.
1921 Hunt, Reginald J. H.
Mitylene, Stanmore-road, Harrow Weald.
1918 Hurrell, Harry Edward.
25, *Regent-street, Great Yarmouth*
1923 Hutton, W. Harrison.
"*Sunnygarth,*" *Ring-road, Moortown, Leeds.*

Elected
1920 Ireland, William Jabez.
88, *Albert Palace-mansions, Lurline-gardens, Battersea Park, S.W.*11
1903 Ives, Frederic Eugene, F.R.P.S., *Member of the Franklin Inst., N.Y., Camera Club, and American Microscopical Soc.,* F.A.A.A.S.
1808, *North Park-avenue, Philadelphia, Pa., U.S.A.*

1922 Jackson, James Joseph.
30, *Windsor-road, Wanstead, E.*11
1923 Jackson, Joseph Taylor, M.Sc.
College House, Bankura, B.N.R., India
1925 Jefferies, F. C. B.
Brynmelyn, Winscombe, Somerset.
1922 Jennison, James.
"*Mount Nod,*" *London-road, Greenhithe*
1901 Johnson, Charles Harold, M.D., C.M., F.R.C.S.E.
22, *The Ridge, Canterbury, near Melbourne, Victoria, Australia.*
1922 Johnson, P. H., B.A., B.Sc., L.C.P., F.R.G.S., F.Z.S.
152, *Camden-road, N.W.*1
1912 Johnston, Thomas Harvey, M.A., D.Sc., F.Z.S.
Professor of Zoology, The University of Adelaide, South Australia.
1918 Jones, Sir Bertram Hyde, K.B.E.
Clovelly, Upper Warlingham, Surrey
1910 Jones, William Llewellyn.
Feremina, St. Martin's, Guernsey, Channel Islands
1923 Judd, Harold Arthur, B.Sc., A.M.I.C.E.
22, *Chapel-lane, Headingley, Leeds.*

1885 Karop, George C., M.R.C.S.
Inniscorrig, Beltinge-road, Herne Bay.
1910 Keeley, Frank J., B.S., E.M., *Member of the Council, Academy of Natural Sciences, Philadelphia; Vice-Director, Mineralogical Section, Academy of Natural Sciences, Philadelphia.*
Box 25, *Merion Station, Penna, U.S.A.*
1925 Kefalas, Andrew, M.B., Ch.B.
21, *Berkley-street, Liverpool, S.*
1918 Kidd, Robert Hicks.
Marlborough-house, Newbury, Berks.
1905 Kitchin, Joseph.
The Mount, 53, *Park-hill-road, Croydon.*

Elected

1897 **Klein, Sydney Turner, F.L.S., F.R.A.S., F.E.S.**
"*Lilly's,*" *Chelsfield, Kent.*

1920 Knight-Hallowes, K. A., M.A. (Cantab.), A.R.S.M. (Lond.), F.G.S., A.Inst.M.M., F.Inst.P., Mem.R.S.L.
50, *Regent's-park-road, N.W.*1

1918 **Koch, Victor M. E.**
c/o Messrs. Carl Zeiss, 153, *West 23rd Street, New York, U.S.A.*

1920 **Lamb, Morris Charles, F.I.C.**
176, *Tower-Bridge-road, S.E.*1

1918 Lancaster, Henry C.
39, *Ladbroke-grove, Holland-park, W.*

1865 Lankester, Sir Edwin Ray, K.C.B., M.A., LL.D., F.R.S., F.L.S., F.Z.S.—PAST PRESIDENT. *Hon. Fellow of Exeter College, Oxford.*
44, *Oakley-street, Chelsea, S.W.*3

1923 Larkin, George Frederick, A.M.I.Mech.E.
Essex House, The Fossway, Farndon, Newark-on-Trent.

1887 **Latham, Miss Vida Annette, M.D., D.D.S.**
1644, *Morse-avenue, Roger's-park, Chicago, Ill., U.S.A.*

1919 Lauwers, Walter H. M., F.P.S.L.
77, *Rue Lamorniere, Antwerp, Belgium.*

1912 Lawson, Peter.
"*Fulham Lodge,*" 7, *Morrale-gardens, Seven Kings, Ilford.*

1914 **Leeson, John Rudd, J.P., M.D., F.L.S., F.R.A.S.**
Clifden House, Twickenham.

1921 **Le Souëf, Leslie Ernest, M.D., B.S.**
c/o Major E. A. Le Souëf, South Perth, West Australia.

1919 **Lissimore, Norman.**
The Clinical Laboratory. 6, *Victoria-avenue, Harrogate.*

1926 Lohman, Kenneth E.
1414, *Gardena-avenue, Glendale, California.*

1925 Lones, John Mason.
"*The Laurels,*" *Westbourne-crescent, Edgbaston, Birmingham.*

1922 **Lowe, Frederick Charles.**
Park-villa, Wharfedale-street, Wednesbury.

1920 **Loxton, Samuel Ernest. F.R.A.S., F.G.S.**
Icknield Little Aston, near Sutton Coldfield Staffs.

1921 **Ludford, Reginald James, Ph.D., B.Sc., F.R.H.S.**
1, *Oakfield-road, Southgate, N.*14, *and University College, W.C.*1

Elected.
1924 Macdonald, Dudley Keppel.
*54, Stebondale-street, Cubitt Town, E.*14

1916 *McEwen, Alfred.
Craig Avel, Tarrytown-on-the-Hudson, New York, U.S.A.

1894 Macintyre, John, M.B., C.M., F.R.S.E.
179, Bath-street, Glasgow.

1922 Mackay, Arthur.
*"Allandale," Ballards-lane, N.*3

1919 Mackay, Rev. A. F. Gordon, D.Sc.
Hector, New York, U.S.A.

1921 McLatchie, John Drummond Pryde. M.B., C.M.
*34, Welbeck-street, W.*1

1925 MacLeod, Evan Greville.
61A, Bold-street, Liverpool.

1884 McMurrich, J. Playfair, M.A.
Anatomical Laboratory, University of Toronto, Toronto, Canada.

1911 Mansfield-Aders, Walter, Ph.D.
Zanzibar, East Africa.

1921 Manson, John James, L.D.S.
167, Canning-street, Glasgow, and Bacteriological Laboratory, Dental Hospital, Glasgow.

1909 Mapp, Charles Richard, B.Sc.
37, Montpellier-terrace, Cheltenham.

1920 Marchment, Reginald Henry.
10, High-road, Wood Green, N.

1926 Mardon, Alfred S. G.
*Wandsworth Canine Clinic, 442, Garratt-lane, S.W.*18

1922 Marx, Major Renold, M.C., B.Sc., *Dipl. Ing.*
*27, Holden-road, Woodside-park, N.*12

1904 Mason, Francis Archibald.
29, Frankland-terrace, Leopold-street, Leeds.

1925 Mason, William Glanvill.
7, Railway-street, Chatham, Kent.

1921 Mathews, Harold J C., F.C.S.
Bridge End Brewery, Burnley.

1925 Matthews, Kilvert Lewis.
Chemistry Section, Department of Agriculture, Dominion Laboratory, Sydney-street, Wellington, New Zealand.

1921 Maurice, Edmund.
*48, Gordon-mansions, W.C.*1

1922 Maxwell, Edward Kelly, B.A.
*10, St. Charles-square, North Kensington, W.*10

1879 *Mercer, A. Clifford, M.D.
324, Montgomery-street, Syracuse, N.Y., U.S.A.

1899 Merlin, Augustus Alfred Cornwallis Eliot.
*3, Cleveland-gardens, West Ealing, W.*13

Elected

1877 **Michael, Albert Davidson**, F.L.S., F.Z.S., F.R.H.S.—PAST PRESIDENT
The Warren, Studland, near Swanage, Dorsetshire. (*See Honorary Fellows.*)

1924 Michie, John Livingston, F.C.S.
8, *Wilton-hill-terrace, Hawick, Scotland.*

1921 **Mignot, Ernest A.**
33, *Ferme Park-road, Stroud Green, N.*4

1924 Millar, William G., M.B., Ch.B.
Pathology Department, University of Edinburgh.

1895 **Millard, Edgar James**, F.C.S.
35–42, *Charlotte-street, E.C.*2

1891 **Miller, John Albert**, M.Sc., Ph.D., F.C.S., *Chemist to the State of New York.*
44 *and* 45, *Lewis Block, East Swan-street, Buffalo, N.Y., U.S.A.*

1912 **Mills, Frederick William**, F.L.S.
Formohun Court, Middle Warberry-road, Torquay.

1923 Minshall, Mark.
Nordenhey, Ethel-road, Bramhall.

1925 Mirza, M. B., B Sc.
Mylius Strasse, 60, *Frankfurt A/M, Germany.*

1905 Moffat, Eliezer.
75, *High-street, Chatham.*

1911 **Mond, Robert Ludwig**, M.A., F.R.S.E., F.Inst.P., F.C.S., F.Ph.S., F.G.S., F.Z.S.
Combe Bank, Sevenoaks, Kent.

1924 Monestersky, David Henry.

1924 Montague, Frederick Robert.
Principal of St. Martin's College, Scarborough.

1924 Morgan, Richard F., Phar D., *Professor of Botany, School of Pharmacy, University of Buffalo.*
139, *W. Oakwood-place, Buffalo, New York, U.S.A.*

1923 Morris, William Edward.
"*Poynings,*" *North Foreland, Broadstairs, Kent.*

1918 **Morrish, William J.**, M.D., etc.
"*Westleigh,*" *Thrale-road, Streatham-park, S.W.*16

1918 **Mortimer, Hugh Hamilton.**
Cissbury, Downlands-road, Purley, Surrey.

1916 **Mosley, Frederick Ormrod.**
University College, Reading, and "*Whernside,*" *Basingstoke-road, Reading.*

1925 Mottram, James Cecil.
*Radium Institute, Riding House-street, W.*1

Elected.
1900 Murphy, Albert John, F.C.S.
2, Dorset-square, N.W.1 and Sheen-lane, S.W.14
1919 Murray, James Alexander, M.D., F.R.S.—PRESIDENT.
Director, Imperial Cancer Research Fund.
8, *Queen's-square, W.C.1*

1926 Nair, S. R., B.Sc
35, *G.M.C. Residency, Byculla, Bombay*, 8
1914 Nall, Rev. George Herbert.
Ayot Lodge, Ayot, St. Peter, Welwyn, Herts.
1924 *Neill, George Dempster.
39, *Hyde-park-gate, S.W.7*
1922 Neill, Robert Macfarlane, M.C., M.A.
Zoology Department, The University, Aberdeen.
1890 *Nelson, Edward Milles.—PAST PRESIDENT.
34, *Apsley-road, Clifton, Bristol.*
1923 Newton, Charles Arthur.
4, *Lansdowne-road, Seven Kings, Essex*
1924 Nigam, Mahadeva Prasad, M.Sc.
Christian College, Lucknow, India.
1911 Noad, Lewis.
7, *King's Bench-walk, Temple, E.C.*
1924 *Nomani, Mah
24, *Cantonment-road, New Delhi, India.*
1899 Norman Albert, L.R.C.P. and L.R.C.S. Edin.
35, *Coleherne-road, Earl's Court, S.W.10*
1921 Norman, Albert.
New Haw, Weybridge.
1922 Norman, J. R.
British Museum (Natural History). S. Kensington, S.W.7
1925 Nurnberg, Roy Charles Albin.
44, *Hornby-road, Fort, Bombay.*

1920 Oakden, Charles H.
80, *Meadow-road, Shortlands, Kent.*
1883 Offord, John Milton.
8, *Culmington-road, West Ealing, W.13*
1907 Ogilvy, James Wilson.
20, *Mortimer-street, W.1*
1919 Oppenheimer, Captain Frank, I.M.S., M.B., Ch.B.
c/o Messrs. Grindlay & Co., Bombay, India.

Elected.
1923 Owen, Charles Todd.
The Logs, East Heath-road, Hampstead, N.W.3
1900 Oxbrow, Alfred William.
7, *Old Haymarket, Norwich.*

1926 Paine, A. Harold.
The Grey House, 48, *Broxbourne-road, Orpington, Kent.*
1924 Palethorpe, Harry Thomas, M.P.S.
8, *Imperial-avenue, Narborough-road, Leicester.*
1910 Palmer, Thomas Chalkley, *President of Delaware County Institute of Science, President of the Academy of Natural Sciences of Philadelphia.*
Media, Delaware Co., Penn., U.S.A.
1924 Parish, Charles B.
Quaker Oats Ltd., 11, *Finsbury-square, E.C.*2
1919 Parish, Rev. Herald.
657, *Liverpool-road, Patricroft, Manchester*
1920 Parker, James Gordon, Ph.D., F.I.C.
176, *Tower-bridge-road, S.E.*1
1923 Parkes, Alan Sterling, B.A., Ph.D.
*Institute of Physiology, University College, W.C.*1
1924 Parsons, The Hon. Sir Charles, K.C.B., M.A., LL.D., D.Sc., F.R.S.
1, *Upper Brook-street, W.*1
1890 *Paterson, Mrs. Catherine Childs.
15, *Compayne-gardens, N.W.*6
1907 Paulson, Robert, F.L.S.
Glenroy, Cecil-park, Pinner, Middlesex.
1898 Payne, Arthur E. T.
Physiological Laboratory, University of Melbourne, Victoria, and Scotsburn, Toorak, Melbourne, Victoria.
1922 Pearce, Herbert.

1884 *Peek, The Honourable Lady.
Widworthy Court, Honiton.
1925 Pilditch, F. W.
66, *Tetley-road, Hall Green, Birmingham.*
1898 Pillischer, Jacob.
88, *New Bond-street, W.*1
1911 Pinchin, Ernest Alfred, B.Sc. (Lond.), F.I.C.
136, *Sternhold-avenue, Streatham-hill, S.W.*2
1924 Piney, Alfred, M.D., Ch.B., M.R.C.P., M.R.C.S.
*Institute of Pathology, Charing Cross Hospital, W.C.*2
1906 Plaskitt, Frederick James Wade.
15, *Uxbridge-road, Rickmansworth, Herts.*

Elected.
1907 Pledge, John Harry.
72, Nibthwaite Road, Harrow, Middlesex.
1926 Pledger, Robert Howland, B.Sc.
Ewell Castle, Surrey.
1919 Poignand, Rev. Cecil W., M.A.
The Beccles, Walsham-le-Willows, nr. Bury St. Edmunds.
1924 Pollard, Hugh B. C.
22, *Loudoun-road, N.W.*8
1902 Poser, Max.
16, *Vick Park B., Rochester, N.Y., U.S.A., and c/o Bausch & Lomb, St. Paul-street, Rochester, N.Y., U.S.A.*
1867 Potter, George.
10, *Priestwood-mansions, Highgate, N.*6
1923 Potter, Herbert.
387, *Moseley-road, Birmingham.*
1922 Potts, T. Trevor.
The Laboratory, Messrs. Robert Fletcher & Son, Ltd., Kearsley Paper Works, Stoneclough, near Manchester.
1919 Pougher, Ernest W., M.M.A.E. M.I.H.V.E.
Burwens, Kirkby Thore, Penrith.
1892 Pound, Charles Joseph.
Director, Stock Experiment Station, Yeerongpilly, Queensland, Australia.
1922 Preston, Joseph Shaw.

1924 Proverbs, Stuart W.
53, *Earlsfield-road, Wandsworth Common, S.W* 18

1898 Radley, Percy Edward, F.Z.S.
Nesta, Broxbourne, Herts, and The Metric Publishing Co., 329, *High Holborn, W.C.*1
1926 Ramanurjam, S. G. Manavala, M.A.
7, *Girdler's-road, Brook-green, West Kensington, W.*14
1896 Ranken, Charles, F.C.S.
11, *Stockton-road, Sunderland.*
1921 Rau, A. Subba, D.Sc., B.A.
*Department of Embryology, Institute of Anatomy, University College, W.C.*1
1917 Rawlins, Francis Ian Gregory, M.R.I.
27 *Storey's Way, Cambridge, and Athenæum Club, S.W.*1
1910 Reid, Alfred, M.B., D.P.H., B.Hy. Durh., M.R.C.S. Eng., L.R.C.P., *Government Medical Officer.*
Kuala Lumpur, Selangor, Federated Malay States.

Elected.

1920 Reid, Duncan James, M.B., C.M.
20, Blakesley-avenue, Ealing, W.5

1899 Rheinberg, Julius.
"*Inglenook*," 12, *Brondesbury-park, N.W.*

1924 Rhys-Davies, William
157, *Leeds-road, Bradford, Yorks*

1898 Richardson, Frederic William, F.I.C., F.C.S., *County Analyst, Bradford, and Oak Lea, Menston, Yorkshire.*

1916 Richardson, John.
11, *Observatory-road, East Sheen, S.W.*14

1921 Roberts, William James David.
21 *Penn road, N* 1

1921 Robins, Edmund Arthur.
"*Gorran,*" *Cassiobury-park-avenue, Watford, Herts.*

1910 *Robins, Herbert George, F.R.G.S.
Toms Farms, Wankie, S. Rhodesia, South Africa.

1924 Robinson, Lieut -Colonel A C
5, *Emperor's Gate, S W* 7

1917 *Robinson, Miss Nancy M.
Glassel House, Glassel, Aberdeenshire.

1899 Rogers, George Henry James.
Wilton Hotel, Grosvenor-gardens, St. Leonards-on-Sea.

1924 Rogers, T. Howard.
16, *Great Western Arcade, Birmingham.*

1921 Room, H. W. Reginald.
Sunnymead, Lansdown-road, Bromley, Kent.

1924 Rosenberg, Augustus
Tollard Royal, Bournemouth.

1911 Ross, John Pilkethly, M.P.S.
c/o Messrs. Stella & Co., Wallace-street, Fort, Bombay, India.

1904 Ross-MacKenzie, John, F.C.S.
Woodleigh, Selborne-road, Barbourne, Worcester.

1918 Rowley, Frank, M.I.M.M.
159, *Adelaide-road, N.W.*3

1897 Rowley, Frederick Richard.
Curator, Royal Albert Memorial Museum, Exeter, and 4, *Victoria-park-road, Exeter.*

1922 Rudd, Frank E., L.D.S., R.C.S.(Eng.)
43, *Prince of Wales-road, Norwich.*

1917 Ryland, Lieut -Colonel Alfred W.
55, *West Cliffe, Preston.*

1924 Sachs, Nathan.
Box 969, *Pretoria, S. Africa.*

1922 Saguchi, Professor Sakae.
Kanazawa Medical School, Kanazawa, Japan.

Elected

1918 Salmon, Walter
"Sandiway," 66, Goldieslie road, Wylde Green, Warwickshire.

1892 *Salomons, Sir David Lionel, Bart., J.P., M.A., D.L., F.R.G.S., F.G.S., F.Z.S.
Broomhill, Tunbridge Wells.

1923 Sansom, George Samuel, D.Sc.
Kennel Moor, Milford, Surrey.

1909 Saxton, Thomas R., Assoc.M.Inst.C.E.
*48, East Bank, Stamford-hill, N.*16

1898 Scales, F. Shillington, M.A., M.D., B.C. (Cantab.).
Redcourt, Adams-road, Cambridge.

1925 Schmehlik, R.
Berlin-Dahlem, M. Schwarzen Grund 25

1925 Schoonhoven, John J., M.A.
773, *Eastern Parkway, Brooklyn, N.Y., U.S.A.*

1880 Scott, Dukinfield Henry, M.A., D.Sc., Ph.D., LL.D., F.R.S., F.L.S.—PAST PRESIDENT.
East Oakley-house, Basingstoke, Hants, and Athenæum-club.

1916 Scott, Joseph Henry.
Oakfield, 8, *Chambers-road, Southport.*

1913 Scott, Wm., F.R.C.V.S.
Friarn House, Bridgwater.

1900 *Scourfield, David J., I.S.O., F.Z.S.
63, *Queen's-road, Leytonstone, E.*11

1907 Scriven, Charles R.
32, *Old Queen-street, Westminster, S.W.*1

1917 Sears, R. S. W.
1, *Lisson-grove, Marylebone, N.W.*1

1924 Setna, Sam B., B.Sc., M.Sc.
Station-terrace, Grant-road, Bombay, India.

1923 Sharif, Mohd., M.Sc.
Entomological Section, Zoological Survey of India, Indian Museum, Calcutta, India.

1902 Sharpe, Charles James.
130, *Fenchurch-street, E.C.*3

1926 Sheard, Hubert V.
25, *Eddison-street, Farsley, near Leeds.*

1885 *Shelley, Major A. D. G., R.E. (Retired).
Hitherbury, Portsmouth-road, Guildford.

1910 Sheppard, Alfred William, F.L.S.
c/o Longmans, Green & Co., 39, *Paternoster-row, E C.*4

1909 Sheppard, Edward James.
137, *Kennington-road, Lambeth, S.E.*11

1924 Short, Henry C.
39, *Villiers-road, Southall.*

1922 Shroff, Peshotan D., B.Sc., *Assistant Professor of Biology.*
c/o The Principal, St. Xavier's College, Fort, Bombay, India.

Elected.
1909 Sidwell, Clarence J. H.
46 *Ashbourne-grove, East Dulwich, S.E.*
1921 Sierra, J. M.
*Biological Laboratory, Cadby Hall, Kensington, W.*14, *and* 7, *Oakley-avenue, W.*5
1912 Simpson, Norman Douglas, B.A., F.L.S.
c/o The Ministry of Agriculture, Cotton Research Board, Giza, Egypt.
1923 Simpson, Robert, B.Sc., A.C.P.
Zoological Department, Victoria University, Manchester
1916 Singer, Charles, M.A., M.D.
5, *North-grove, Highgate, N.*6
1925 Singh, Bawa Balwant, M.Sc.
Ewing Hall, Lahore, India.
1918 Skepper, Harry Godfrey.
"*Lindum,*" *Brothertoft-road, Boston, Lincs.*
1924 Smiles, John, A.R.C.S.
22, *Coniston-road, Muswell Hill, N.*10
1925 Smith, Charles A.
48, *St. John's-road, Holloway, N.*7
1917 Smith, Joseph, F.S.A.A.
"*Kenwyn,*" 90, *Kenwyn-road, Ellacombe-road, Torquay.*
1897 Soar, Charles David, F.L.S.
10, *Westmoreland-road, Barnes, S.W.*13
1918 Springall, Hubert F.
The Friars, King's Lynn.
1903 Spry, Robert, Lieut.-Commander, R.N.
Heaton Lodge, Bladderley-road, Plymouth
1925 Stansfield, Victor.
Lawes Agricultural Trust, Rothamsted Experimental Station, Harpenden, Herts.
1909 Stewart, Thomas S., M.D.
153[illegible], *Pine-street, Philadelphia, Pa., U.S.A.*
1900 Stiles, Matthew Henry.
10, *Avenue-road, Doncaster.*
1921 Stobart, Captain Henry Francis.

1914 Strachan, James, F.Inst.P.
74, *Blenheim-place, Queen's Cross, Aberdeen.*
1923 Stream, Ernest John, M.A. (Cantab.).
"*Glenville,*" *Heneage-road, Grimsby.*
1871 Stuart, John.
3, *North-side, Clapham-common, S.W.*4
1921 Stump, Dan M., B.S., M.E.
5657, *W. Washington Boulevard, Chicago, Ill., U.S.A.*
1918 Sutcliffe, Herbert.
The Research Laboratory, Petaling, Federated Malay States.

Elected.

1920 Sutherland, Donald, M.A., F.R.S.G.S.
"Golden Hurst," 20, *Carmunnock-road, Cathcart, Glasgow.*

1922 Suttie, James. F.C.O., D.C.O., F.N.A.O.
Douglas-chambers, Old Cross, Hamilton.

1919 Swainson-Hall, R., F.L.S., F.C.S.
"Willow Dene," Isle of St. Helena.

1906 Swift, Mansell James.
81, *Tottenham-court-road, W.*1

1889 Sykes, Mark Langdale.
Lanton House, The Strand, Ryde, Isle of Wight.

1911 Tabor, Charles James, F.R.A.I.
The White House, Knott's-green, Leyton, Essex.

1891 *Talmage, James Edward, D.Sc., Ph.D. F.R.S.E., F.G.S., *Professor of Geology, University of Utah, Salt Lake City, Utah, U.S.A.*
The Deseret Museum, Salt Lake City, Utah.

1925 Talmage, Sterling Booth, M.Sc.
Dept. of Zoology, Northwestern University, Evanston, Ill., U.S.A.

1900 Taverner, Henry.
Wrekin House, 319, *Seven-Sisters-road, Finsbury-park, N.*4

1915 Taylor, Frederick H.
County Bank, Chorley, Hants.

1891 Terry, Edwin, F.C.S.
Sunbury House, 374, *Brixton-road, S.W.*9

1921 Thapar, Gobind Singh, M.Sc., Ph.D., *Professor of Zoology.*
Department of Zoology, The University, Lucklow, India.

1923 Thomas, Evan John, M.P.S.
229, *Park-road, Cwmpark, Treorchy, Glam.*

1885 *Thomson, J. Arthur, M.A., LL.D., F.R.S.E., F.Z.S.—Past President. *Regius Professor of Natural History in the University of Aberdeen.*
Natural History Department, Marischal College, University, Aberdeen, and Castleton House, Old Aberdeen.

1912 Tierney, Clarence, D.Sc., F.L.S.—Hon. Secretary.
"Netherton," Coulsdon, Surrey.

1923 Tipnis, Eknath Ganesh, B.A.
National Medical College, 2nd Victoria Cross-lane, Bombay, No. 10

1923 Titchener, George R.
10, *Dalberg-road, Brixton, S.W.*2

1926 Titchener, J. B.
61, *Brailsford-road, Brixton, S.W.*2

Elected
1925 Toorkey, Dinshaw Rustumji, B.Sc.
133, Prendergast-road, Secunderabad, Deccan, India.
1920 Trinder, George A. W., M.J.I
*100, Marine-street, W.*10
1917 Tripp, Charles Llewellyn H., M.R.C.S., L.R.C.P.
Woldingham Chace, Woldingham, Surrey.
1925 Troughton, Henry George.
*5, Stone Buildings, Lincoln's Inn, W.C.*2
1924 Turner, Albert.
Brookhouse Cottage, Prestbury, Cheshire.
1920 Turner, William.
21, *Vera-road, Fulham, S.W.*
1882 Tuttle, Albert Henry, M.Sc.
University of Virginia, Charlottesville, Va., U.S.A.

1913 Verrall, Frederick H., B.A., LL.B.
The Hollies, Worthing, Sussex

1923 Wallis, Thomas Edward, B.Sc., F.I.C., Ph.C.
23, *Leicester-road, East Finchley, N.*2
1909 Walter, Rev. Frederick William.
The Manse, Kelvedon, Essex.
1923 Warbrick, John Clark, M.D.
306, *East 43rd-street, Chicago, Ill., U.S.A*
1920 Ware, John William.
c/o South African Drug Houses, P.O. Box 1441, *Durban, Natal, South Africa.*
1885 Warner, Edmond.
5, *York Gate, Regent's Park, N.W.*1
1911 Warrington, Capt. A. F. G., F.R.G.S.
c/o Messrs. Gray Dawes & Co., 122, *Leadenhall-street, E.C.*3
1888 Waters, Arthur William, F.L.S., F.G.S.
Alderley, McKinley-road, Bournemouth.
1921 Watkin-Brown, W. Thomas, J.P.
24, *Bowns-road, Kogarah, Sydney, N.S.W*
1919 Watkinson, Harry.
Westwoods, Welholme-road, Grimsby.
1919 Watts, George William, L.D.S.Eng.
"The Ferns," The Burroughs, Hendon. Middlesex.
1912 Webb, Wilfred Mark, F.L.S.
The Hermitage, Hanwell, W.
1924 Welch, Frank Victor.
152, *Broadway, West Hendon, N.W.*9
1920 Welsford, Miss Evelyn Janie, M.B.E., F.L.S.
Department of Agriculture, Zanzibar.

Elected.

1920 Westerdyk, Tidde.
Keizersgracht, 642–44, *Amsterdam*, *Holland.*

1919 Whipp, James Ewart, M.P.S.
15, *St. John-street*, *Longsight*, *Manchester.*

1886 *Whitehead, Ralph Radcliffe.
Woodstock, *Ulster C.*, *N.Y.*, *U.S.A.*

1920 Whitfield, Herbert Charles.
6, *Kassala-road*, *Battersea-park*, *S.W.*11

1898 *Whittaker, Oscar, F.E.S.
Box 552, *Chilliwack*, *British Columbia.*

1915 Whitteron, Frederick, B.A.
475, *Latrobe-street*, *Melbourne*, *Victoria*, *Australia.*

1913 Wigan, Basil P., F.C.S.
Rhondda-valley Breweries Co., *Treherbert*, *S. Wales.*

1910 *Wilding, Percy P.
Fern Nook, *Penwortham Hill*, *Preston*, *Lancs*

1921 Wildman, J. T. R.
36, *Etherley-road*, *South Tottenham*, *N.*15

1922 Wilkie, Henry Charles, F.R.C.V.S., Hon. F.Z.S.
c/o Messrs. Coutts and Co., 440, *Strand*, *W.C.*2, *and "Bosleven*," *Tremthen-road*, *Penzance.*

1922 Williamson, William, F.R.S.E., F.L.S.
7, *Ventnor-terrace*, *Edinburgh.*

1925 Wills, H. Haydyn, F.C.S.
17, *Green Lane*, *Redruth.*

1908 Wilson, Joseph.
The Hawthorns, 3, *West-park-road*, *Kew-gardens.*

1911 Wilton, Edmund Wade, A.I.S.E., F.S.A.
Planet Works, *Bramley*, *Leeds*, *and Swinnow House*, *Pudsey*, *Yorks.*

1923 Woodger, Arthur George
41, *Arlington-gardens*, *Chiswick*, *W.*

1880 *Woodward, Bernard B., F.L.S., F.G.S.
4, *Longfield-road*. *Ealing*, *W.*5

1889 Wright, Charles Henry.
10, *Clarence-road*, *Kew.*

1925 Wright, Rev. Frederick James, M.B.A.A.
Trinity House, *New Lane*, *Oswaldtwistle*, *Lancs.*

1925 Wright, H. Cameron.
3, *Stanhope road*, *Highgate*, *N.*6

1882 Wright, Prof. R. Ramsay, M.A., B.Sc.
9, *Moreton-road*, *Oxford.*

1921 Wrighton, Harold, B.Met.
64, *Kinveachy-gardens*, *Charlton*, *S.E.*7

1900 Wyatt, William.
Rutland House, *Ellesmere-park*, *Eccles*, *Manchester.*

1919 Wycherley, Sydney R.
"*Netherleigh*," *Keswick-road*, *Orpington*, *Kent.*

1921 Wyn-Miller-Williams, E. B.
Warpool-court, *St. Davids*, *S.O.*, *co. Pembroke.*

Elected.

1890 *Youdale, William Henry.

1918 Young, George William.
20, *Grange-road, Barnes. S.W.*

1920 Zwick, Karl George, Ph.C., Ph.D., M.D.
Doctors' Building, Garfield-place Cincinnati, U.S.A.

HONORARY FELLOWS.

Elected.

1879 Balbiani, E. G.
Paris.

1918 Bruce, Lady Mary Elizabeth, R.R.C.
London.

1925 Ewell, Marshall D., M.D.
Memphis and Treasure Island, U.S.A.

1905 Jennings, H. S.
Baltimore.

1897 Lee, A. Bowles.
Les Tilleuls, Tavel, Clarens, Vaud, Switzerland.

1919 Michael, Albert Davidson, F.L.S., F.Z.S., F.R.H.S.
The Warren, Studland, near Swanage.

1912 Penard, Dr. Eugen .
2, *Rue Topffer, Geneva.*

1904 Ramón y Cajal, S.
Madrid.

1923 Rendle, Alfred Barton, M.A., D.Sc., F.R.S., F.L.S., etc.
*British Museum (Natural History), London, S.W.*7

1879 Sars, G. O.
Christiania.

1904 Teall, J. J. H.
London.

1879 Warming, E.
Copenhagen.

1905 Wilson, E. B.
New York.

1905 Wood, R. W.
Baltimore.

Patron.

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*John Lindley, Ph.D., F.R.S.	1842–[illegible]
*Thomas Bell, F.R.S.	1844–5
*James Scott Bowerbank, LL.D., F.R.S.	1846–7
*George Busk, F.R.S.	1848–9
*Arthur Farre, M.D., F.R.S.	1850–1
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*William Benjamin Carpenter, C.B., M.D., LL.D., F.R.S.	1854–5
*George Shadbolt	1856–7
*Edwin Lankester, M.D., LL.D., F.R.S.	1858–9
*John Thomas Quekett, F.R.S.	1860
*Robert James Farrants, F.R.C.S.	1861–2
*Charles Brooke, M.A., F.R.S.	1863–4
*James Glaisher, F.R.S.	1865–6–7–8
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*William Kitchen Parker, F.R.S.	1871–2
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*Henry Clifton Sorby, LL.D., F.R.S.	1875–6–7
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*Lionel S. Beale, M.B., F.R.C.P., F.R.S.	1879–80
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Albert D. Michael, F.L.S.	1893–4–5–6
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*William Carruthers, F.R.S., F.L.S., F.G.S.	1900–1
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*Henry Geo. Plimmer, F.R.S., F.L.S., F.Z.S., etc.	1911–12
*Sir German Sims Woodhead, M.A., M.D., LL.D., F.R.S.E., etc.	191[illegible]
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